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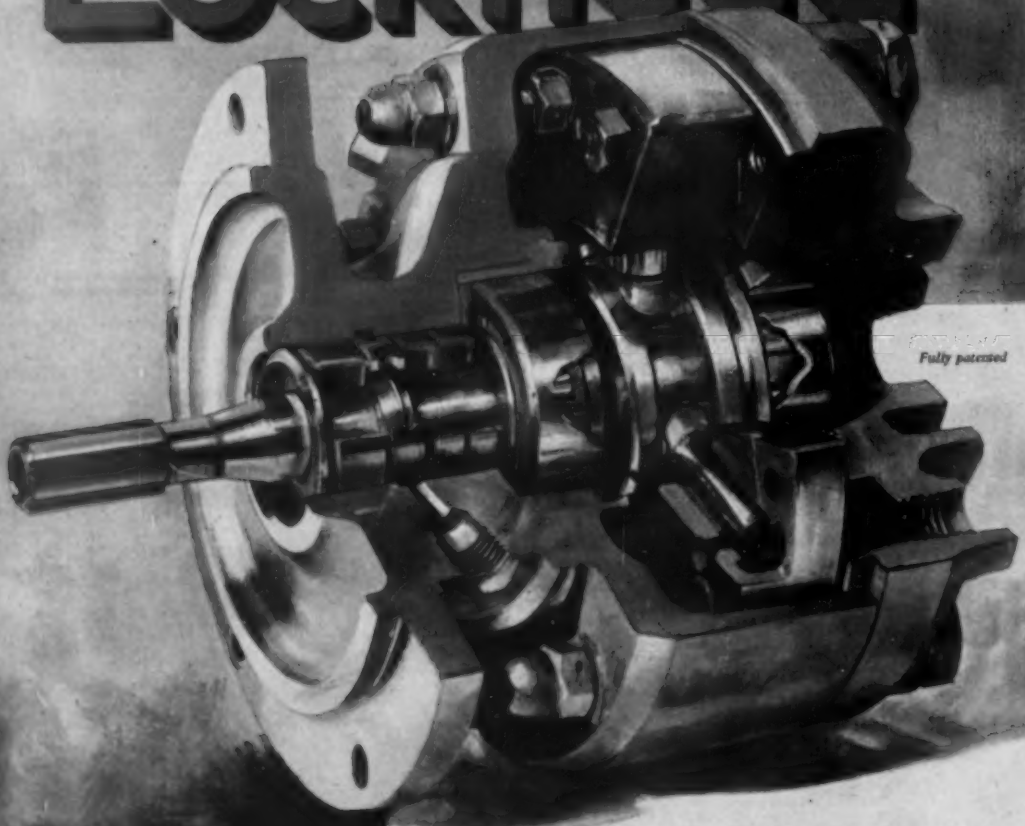

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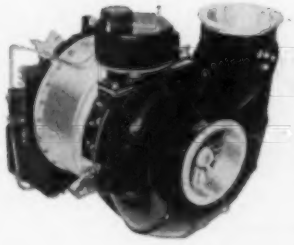

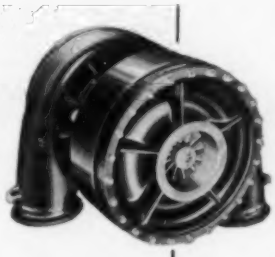

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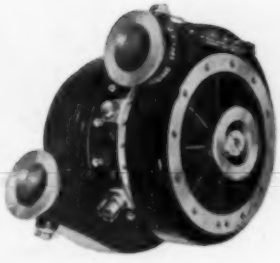

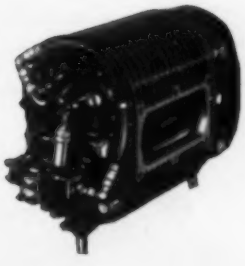

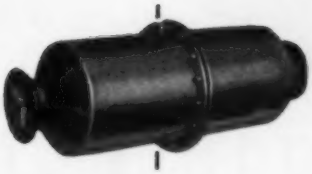

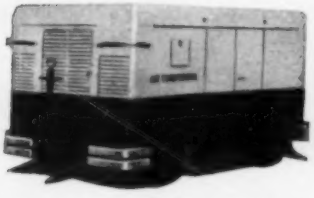

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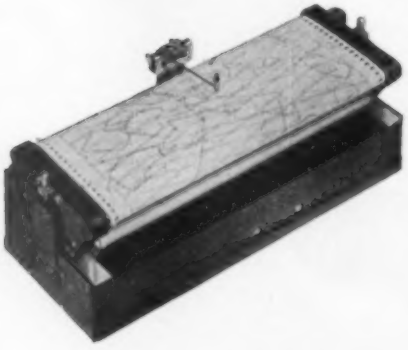
(c) In the terminal area applications, the Flight Log has proved most useful from the standpoints of the ease and accuracy with which it is possible to maintain holding procedures, and in ensuring a smooth and rapid transition from the holding pattern to the feed in point associated with the particular final approach aid to be used. Taking advantage of Decca we have found it possible, in the London area in particular where traffic conditions have permitted, to shorten the normal approach procedures by using the Flight Log to feed directly on to the final approach aid.

In general pilots are enthusiastic about the Flight Log type of display and consider that it can ease the cockpit workload considerably.



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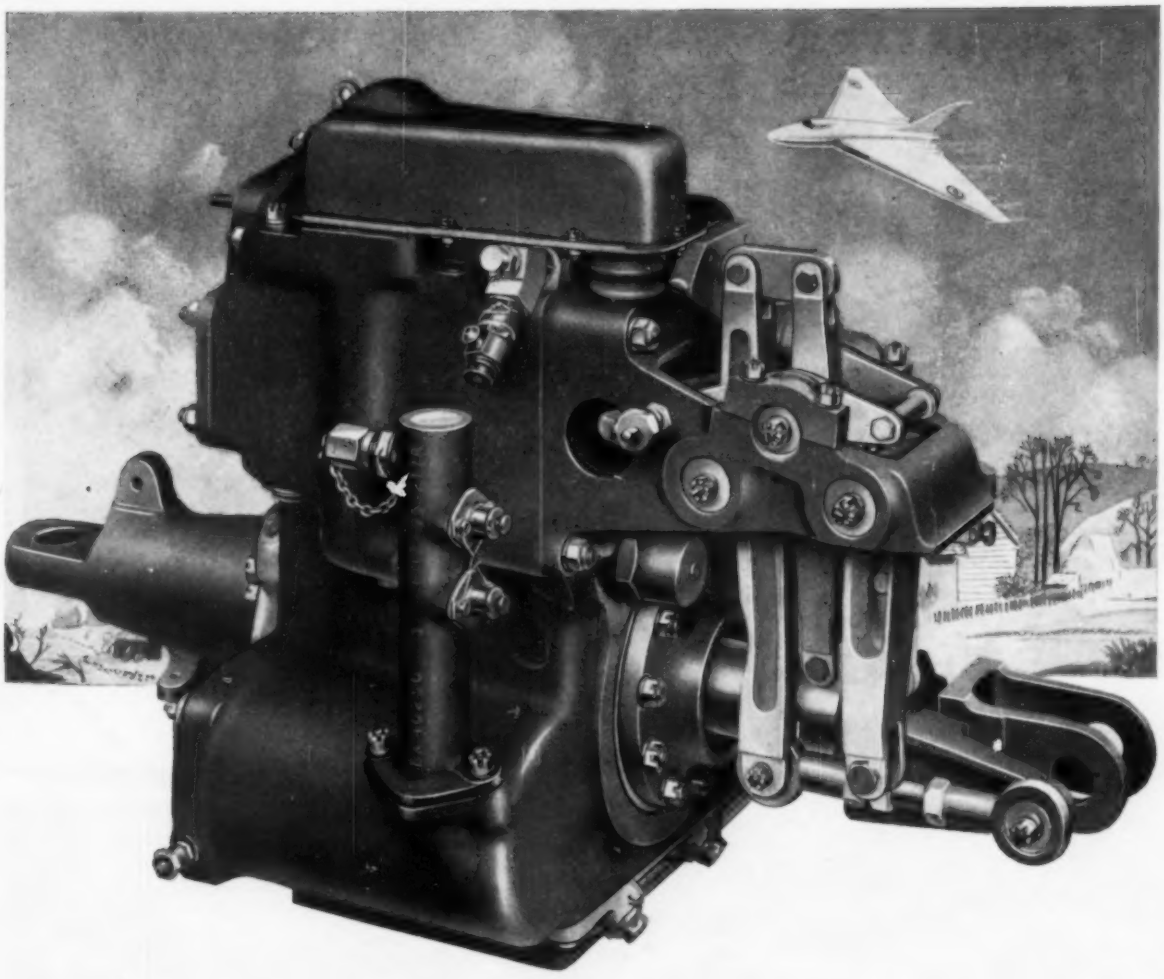

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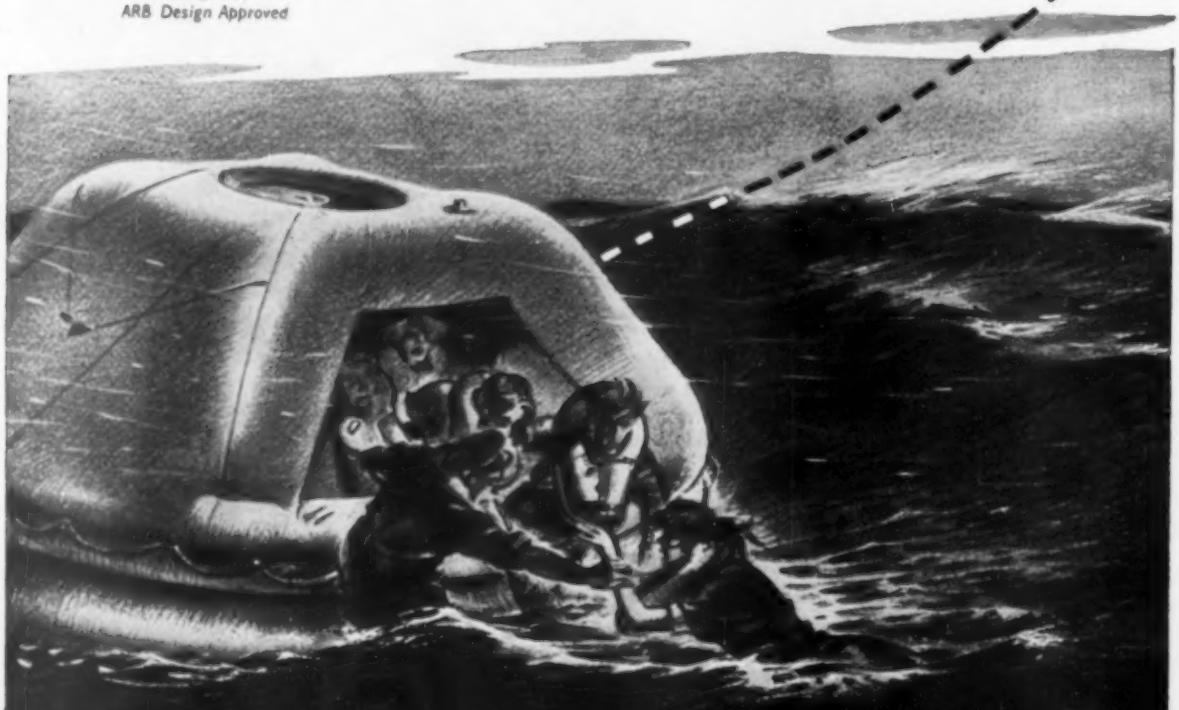

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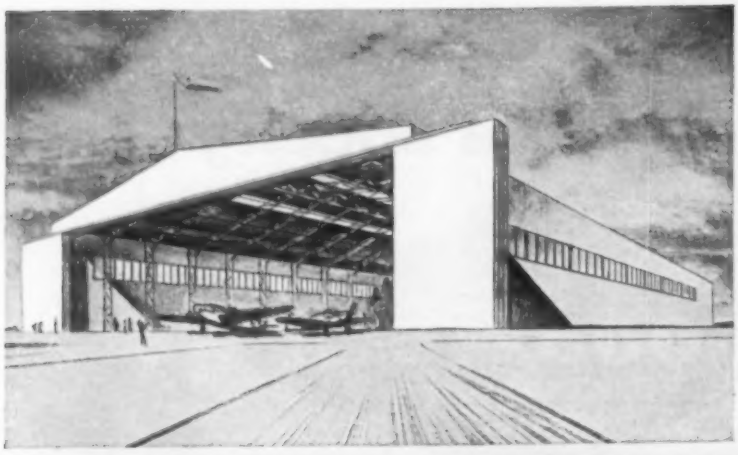

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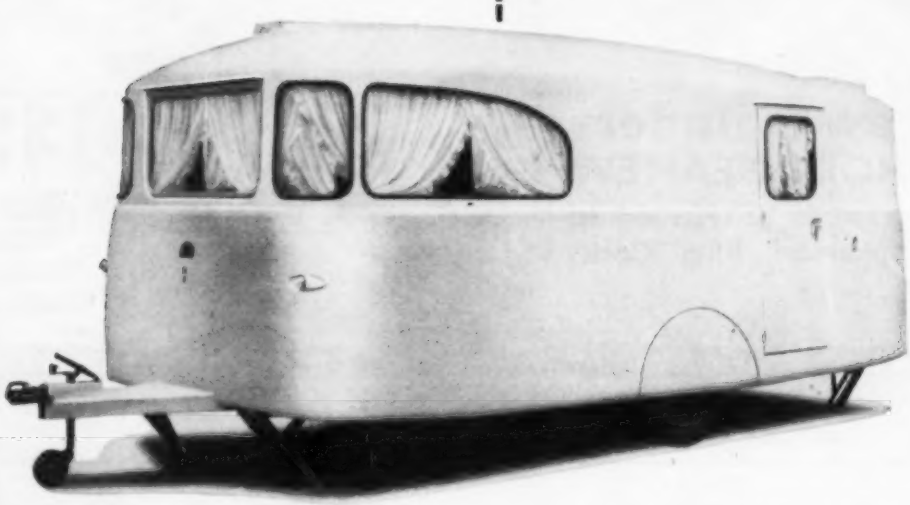

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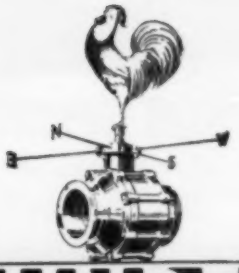

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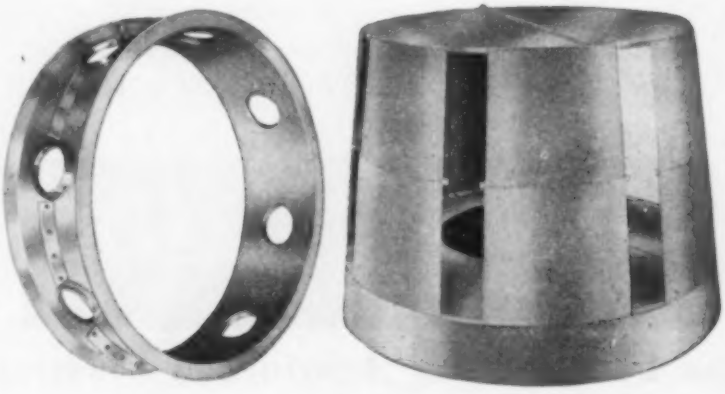

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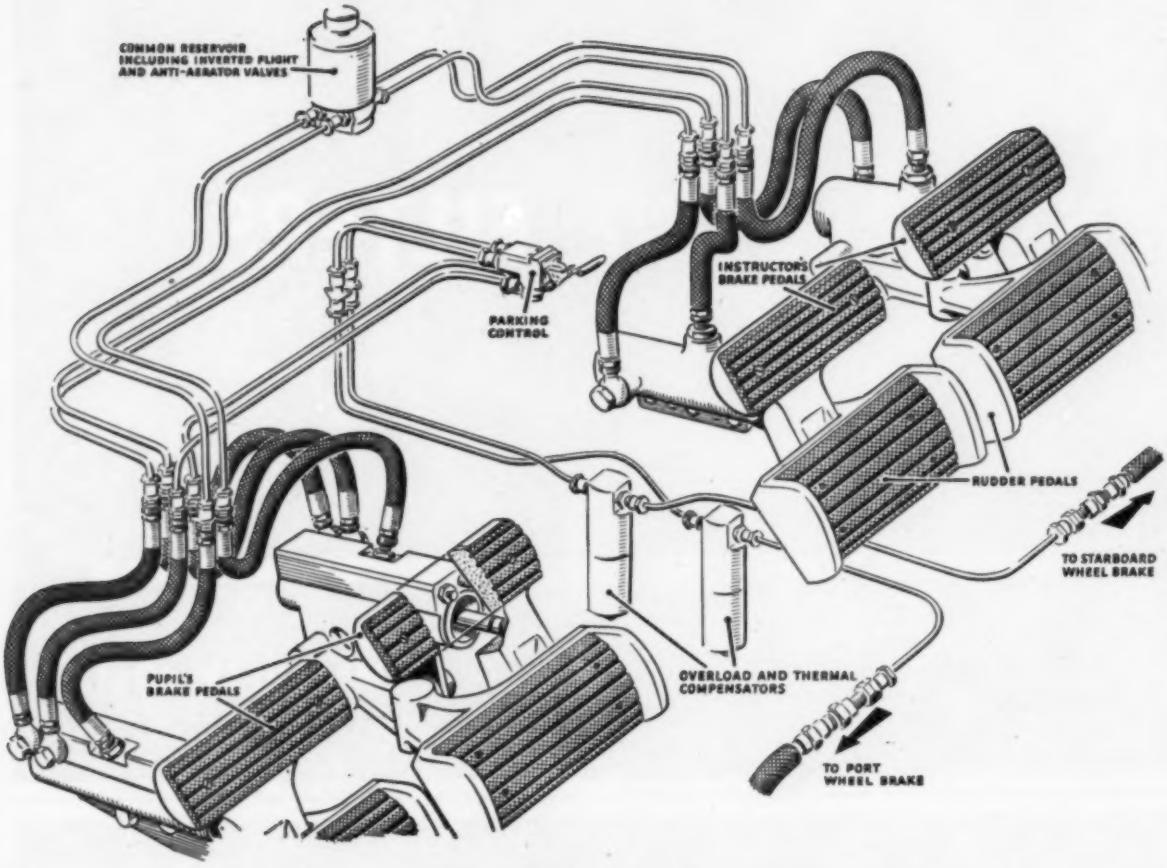

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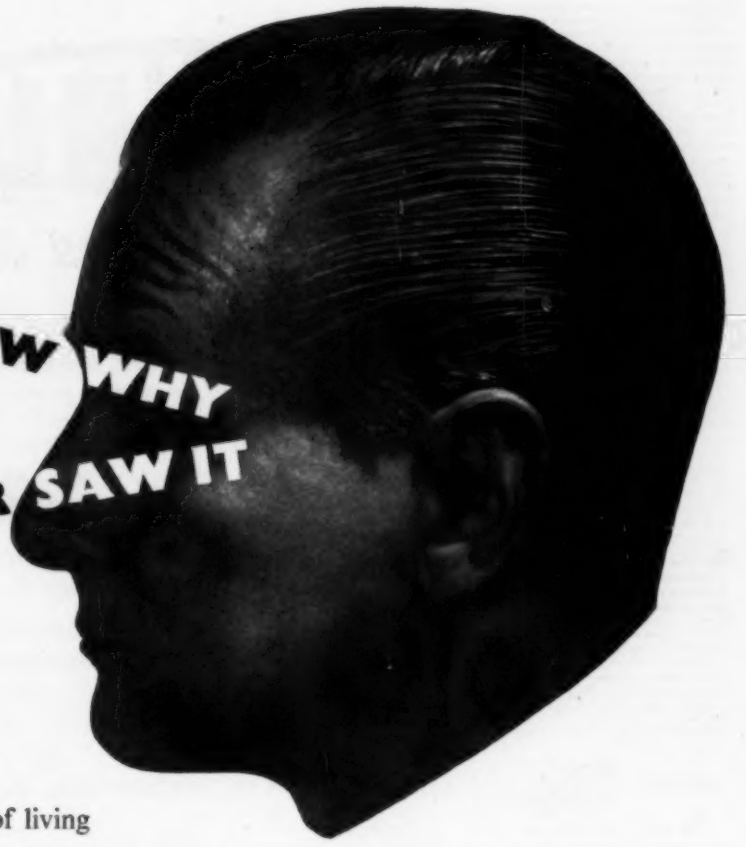

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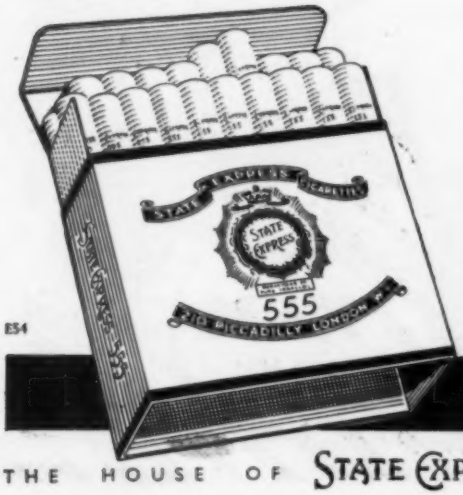

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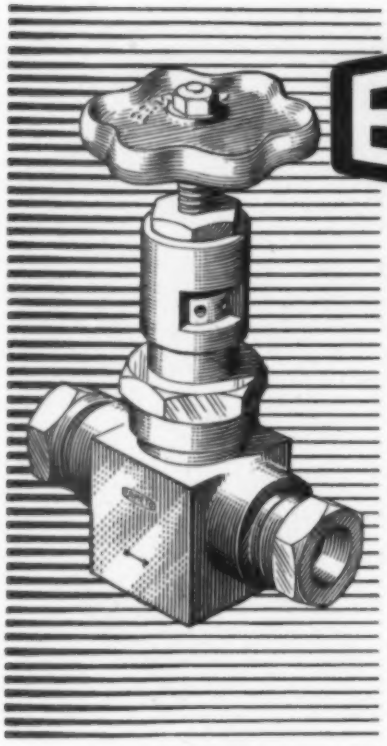

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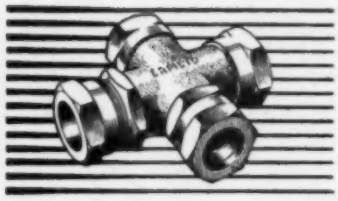

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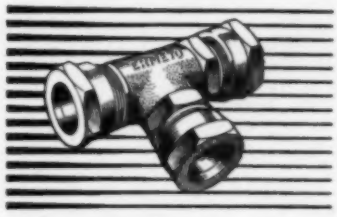

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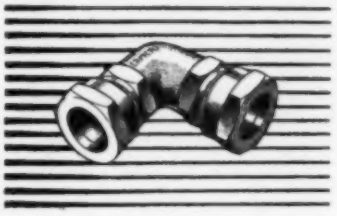

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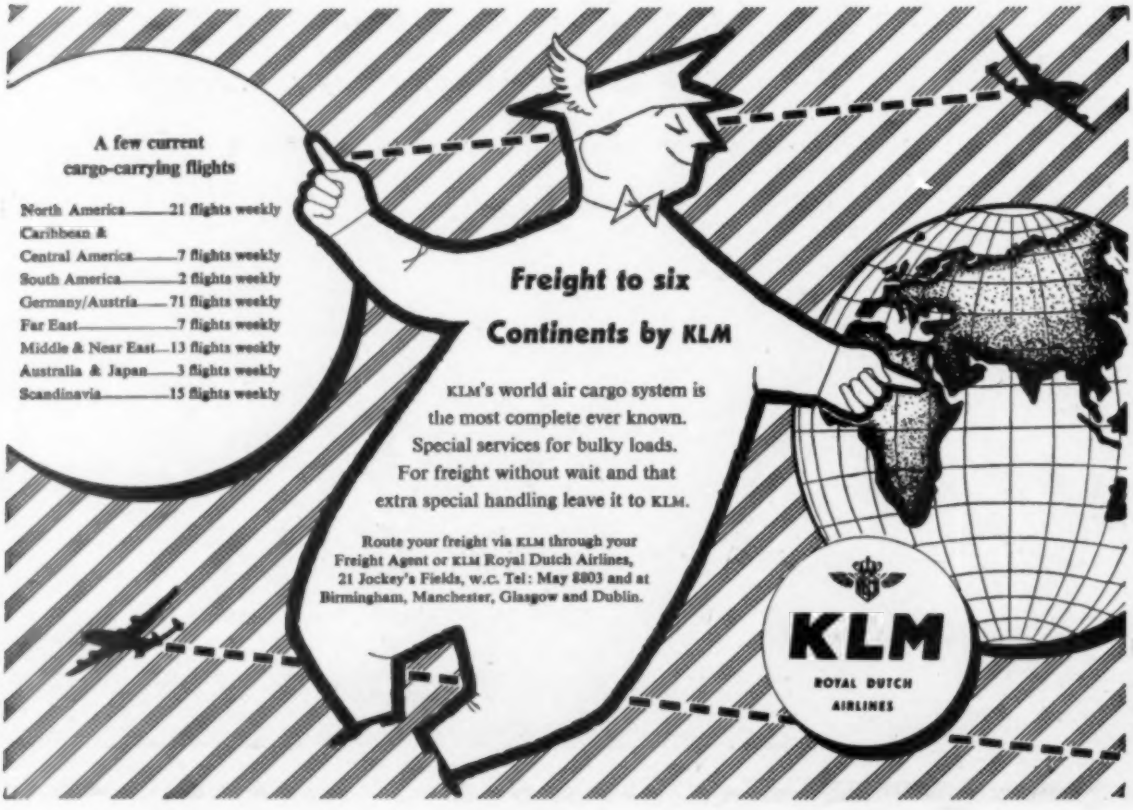
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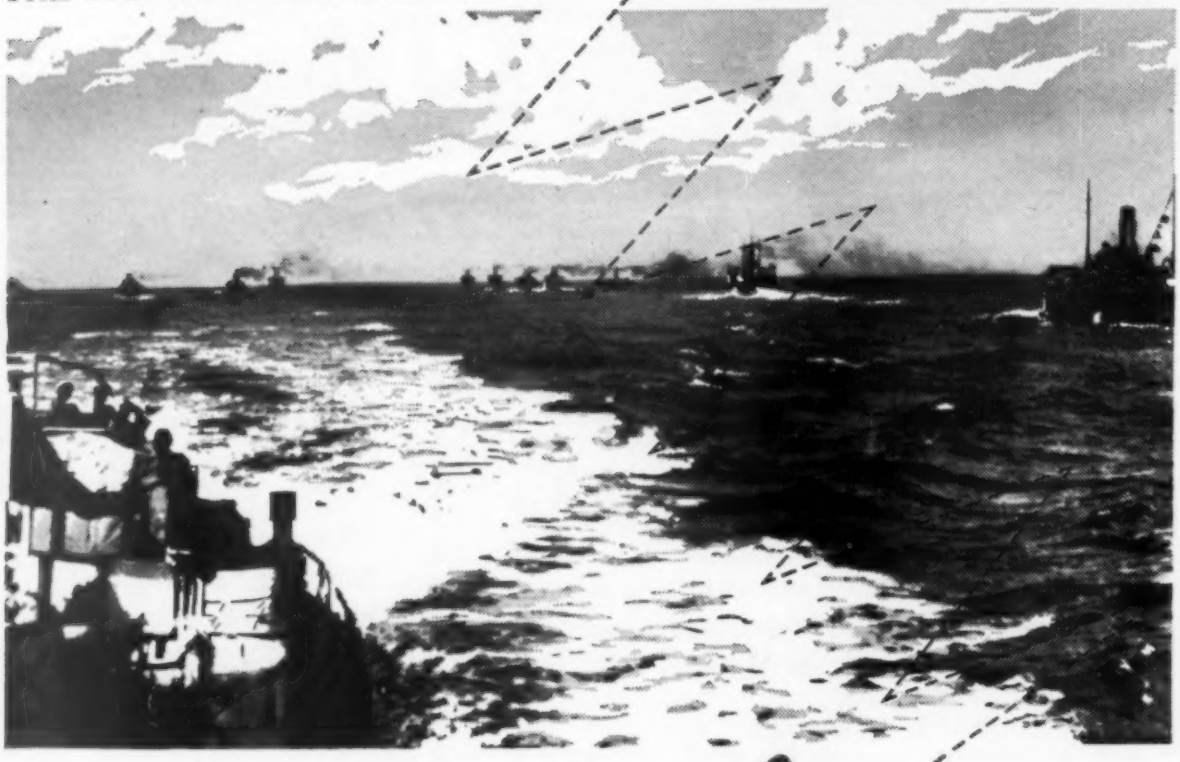
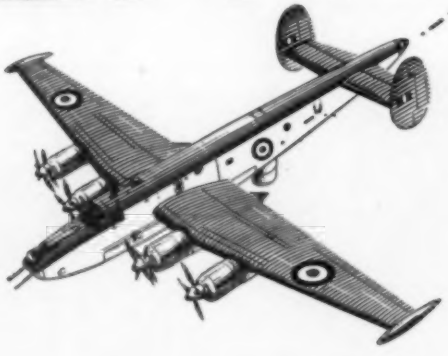


Long Range Maritime Reconnaissance



The long range Avro Shackleton Mark 3 is a formidable air weapon. In its vital role of Maritime Reconnaissance the principal requirement is endurance—endurance of the aircraft, its equipment and the crew. The Shackleton is manned by a crew of ten men trained to exercise the utmost vigilance during long patrols. The sensitive search and detection apparatus alone accounts for nearly 1½ tons of equipment. There is even room for a large comfortable ward room with an all-electric galley where pre-cooked meals can be prepared.

This great aircraft is now in production for the Royal Air Force Coastal Command and the South African Air Force. It is an air weapon which can be used as an integral part of defence plans for the protection and support of sea-borne commerce. Its search and striking power make it the submarine's worst enemy. It can also carry out vital air sea rescue missions to shipwrecked mariners. A few squadrons can provide effective patrols and striking forces over vast stretches of ocean in climates ranging from tropical to arctic.

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FLIGHT
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AIRCRAFT ENGINEER

No 2455 Vol 69 FRIDAY 10 FEBRUARY 1956

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Stalking the Hunter

JUST when it seemed that the Hawker Hunter—assessed last year by the U.S. Defense Department as the best day intercepter in Europe—was settling down to the general satisfaction of all concerned (though still under operational restrictions) a double-barrelled discharge from the thickets of Fleet Street kicked up another flurry of dust round this much-potted-at fighter. Had "the R.A.F.'s main fighter plane", the *Daily Express* demanded, proved incapable of using the guided missiles which would be the only weapons effective against modern bombers?

Next day the fur was again ruffled, if not actually set flying, in the House of Commons, when Mr. Strachey asked the Air Minister whether he was satisfied with the Hunter's performance; whether restrictions on firing its guns could be lifted; how far it was still intended to proceed with production in the numbers originally contemplated; and if greater reassurance could be given that "this fine aircraft" would be got through its teething troubles before it was obsolete. Which drew from Mr. Birch assurances that the Hunter had "proved its flying qualities in the Service"; that though there were certain restrictions on gun firing and a programme of modifications was in progress, it was hoped that a number of modified aircraft would be operational before the summer; and that there would be a small reduction in orders.

Diligent readers of *Flight* are aware, of course, that the Hunter's "flying qualities" were enthusiastically endorsed by squadron pilots over a year ago. As for the armament modifications, it must be admitted that these are taking an uncomfortably, if not unconscionably, long time, though the production cutback, affecting fifty machines, is of relatively minor consequence.

Having regard to the newly stimulated interest in the Hunter's missile capability, it is regrettable, of course, that no official word should have been uttered on the subject; nor, as we write, can any useful comment be made, beyond recalling that a Hunter appeared at the S.B.A.C. Display last year with an impressive under-wing load of two 1,000 lb bombs (not far removed in form and weight from typical guided weapons) as well as batteries of unguided rockets.

There are at least three possible explanations of any deficiencies which might underlie current restlessness: that provision for guided weapons was not written into the original specification and that subsequent difficulties of adaptation arose; that certain patterns of missile can be handled, but not others; and that, whereas the Hunter is physically capable of carrying and launching missiles, the pilot's means of location and direction are inadequate. Or it may well be that present fears are wholly baseless.

We must hope that, when the answer comes, it will come unalloyed.

In the Queen's Service

IT is the clear duty of the Air Ministry and Treasury to agree forthwith on a plan for the re-equipment of the Queen's Flight, in part, if not in whole. At least they must provide for more suitable aircraft for Royal service than have been available on the recent tour.

We do not advocate thereby that a Britannia should be constantly at the Royal command in the way that Super Constellation *Columbine* is at the call of Mr. Eisenhower and America's statesmen; but we are acutely aware, as are so many of Her Majesty's subjects, that Argonauts and Vikings are no longer worthy—in terms of speed and comfort at least—to bear our Royal personages on their long and arduous journeys.

Imperative now is a study of how best the Royal Family may be served, having regard to the types of military aircraft on order. The demands of their high calling must go no longer unfulfilled; nor must their dedicated use of the air be answered by anything but the best—or the best that can by any reasonable means be put to their service.

FROM ALL QUARTERS

DUNSFOLD TO DENMARK: The two Danish Air Force pilots, Maj. P. Thorsen (right) and Lt. B. W. Andersen, who collected the Hunters (see below).

Air A.D.C. to the Queen

IT was announced in the *London Gazette* on January 1st that the Queen had been graciously pleased to approve the appointment of Air Chief Marshal Sir Francis J. Fogarty, K.C.B., K.B.E., D.F.C., A.F.C., to be Air *Aide-de-Camp* to Her Majesty with effect from January 29th. Sir Francis, who succeeds Air Chief Marshal Sir Arthur Sanders, G.C.B., K.B.E., on the latter's retirement, has been Air Member for Personnel since November 1st, 1952. Before that he had been Commander-in-Chief, Far East Air Force, from November 1949 and Senior Air Staff Officer, Flying Training Command, from June 1947. Sir Francis enlisted in the R.F.C. as a cadet in April 1917 and was commissioned within four months. At the outbreak of the Second World War he was a wing commander in command of a bomber squadron.

Hunters for Denmark

THE first two Hunters of a large order from Denmark were delivered on January 30th. They were flown from the Hawker airfield at Dunsfold, Surrey, by two Danish Air Force pilots, seen in the photograph on this page.

It was reported from Copenhagen on February 2nd that Danish defence officials had said that the British Government and the manufacturers of the aircraft had undertaken to carry out modifications. It was also stated that the 60 million kroner (about £3m) order was for 30 aircraft.

—and the New Luftwaffe

IT was semi-officially stated in Bonn last week that the West German Air Force is expected to be fully manned and equipped by the beginning of 1960. The total strength is to be 100,000 men, with 1,326 aircraft. Some 20,000 men are scheduled to complete their training by the end of March 1957; what proportion of this number will receive pilot training is not stated. Another report from Germany says that 324 of the 1,326 aircraft will be Hunters, the remaining first-line types being F-100s, F-102s and F-84Fs. There will be a total of 20 squadrons—four fighter, eight fighter-bomber, three reconnaissance and five transport and miscellaneous.

Col. Panitzki, of the Defence Ministry, is reported to have said of the Hunters: "They are not ideal for fighting, but they will suffice us for training."

Tripartite Airliner: Decision Pending

LAST Friday's newspaper report that the Government has "vetoed" the Bristol-Convair-Canadair project for a 500-m.p.h. turboprop airliner appears to have been at least premature, since at that time the three companies concerned had yet to make their final policy decision. A meeting was due to take place in New York this week at which senior executives of General Dynamics and Bristol, including Mr. Peter Masefield, were to discuss, and act on, the technical evaluation of the project completed a few days previously at San Diego. It may well be true that the Government has not actively encouraged the project; whether it would veto it is another matter. At the time of going to press the Ministry of Supply would make no comment on the report, which appeared in the *Daily Mail*.

Two-spool Improvement

IT can be revealed that Bristol Olympus turbojets now in production have a type-tested rating of 12,000 lb dry. Although substantially similar to the first production engine—the Olympus 101, rated at 11,000 lb—the present production Olympus BOl.11, incorporates detail improvements. Apart from the new rating the only publishable details of the BOl.11 are the overall length (156.2in), the diameter (40in) and the fact that it has ten flame-tubes. The latter applies to all Olympus types so far revealed. A full description of the first versions of the Olympus was published in our issue of December 9th, 1955.

It can also now be stated that the BOl.11 was the engine installed in the Bristol company's Canberra test-bed which last August established a new world height record for aeroplanes. The record has now been ratified at 65,890ft (20,083m), this value being 14ft higher than that originally claimed.

Fatigue Conference

SEVENTEEN of the world's leading authorities on fatigue in aircraft structures met in New York on January 30th for a three-day conference. Numerous papers on engineering, aircraft design and solid-state physics were read by delegates from several countries, in particular from the U.S.A., Britain, Sweden and Germany.

The venue of the conference was Columbia University and Dr. A. M. Freudenthal of the Columbia Institute of Flight Structures (which organized the meeting) pointed out that there had been a number of aircraft accidents resulting from fatigue-induced structural failure before the Comet 1 gave the subject notoriety. Most of these earlier disasters had been to military fighters and the air forces concerned had had no desire to advertise the matter. One of Dr. Freudenthal's sentences is worth quoting: "30,000 hours used to be the life-span of an airframe. Now, with million-dollar airplanes, we must build planes with at least 100,000 or 200,000 hours."

"D.H." on British Airliners

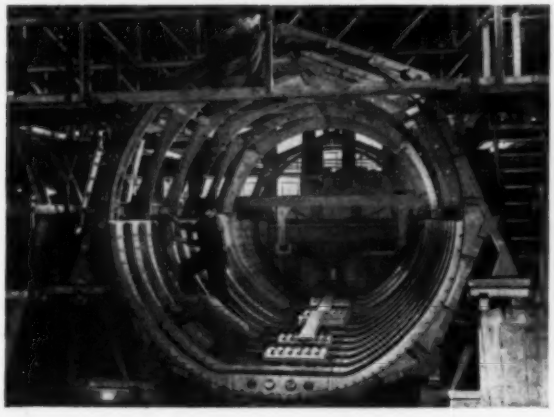
DURING the past few weeks there have been a good many prescriptions from outside the industry for the future health of British business in the world airliner market. Some have been well reasoned, others decidedly quack. When the voice of the patient industry (which after all has more at stake than anyone) is heard, it is as well to take careful heed—particularly when the voice is that of Sir Geoffrey de Havilland, who rarely enters the lists of public controversy. In an article in the *Financial Times* on February 2nd, he emphasizes that the home market for large airliners needs to be considerably enlarged if British builders are to organize production enabling them to export successfully.

"Well developed civil and military air transport operations," he says, "besides themselves strengthening our trade and defence, ensure a good home demand and production, which facilitates the export of airliners, which strengthens the industry still further, which accelerates technical development, which in return assists our own operations and further helps export." To achieve larger-scale home civil and military operations we needed to face the fact that a strong civil and military airliner industry is "one of the most important and basic requirements of defence and prosperity." It was obvious that a wider network of British—and British Commonwealth—airlines would generate a military reserve and system of ground bases of considerable value in an emergency. "Nearly all defence measures are a load on the taxpayer. Shipping and air transport—essential to defence—can be revenue earners. . . . We see how closely civil and military considerations are locked together. Air power and commercial prosperity are one."

"FLIGHT"

Owing to the dispute in the Printing Trade this issue has had to be reduced in size and copies may be late in reaching readers. To all who are inconvenienced in any way we offer our sincere regrets in circumstances beyond our control.

BELFAST BRITANNIAS

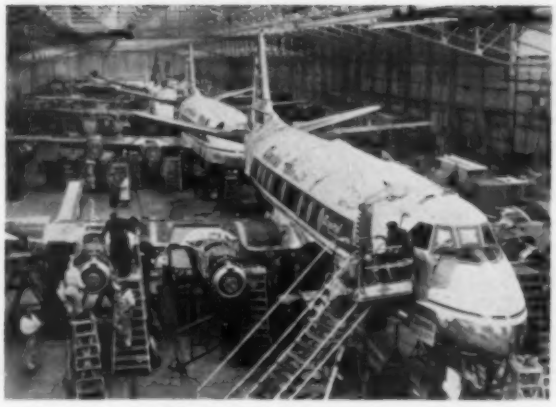


THESE three photographs were taken in the main Queen's Island factory of Short Brothers and Harland, Ltd., at the end of last month. They give a good impression of the manner in which production of the Bristol Britannia is building up.

At present Shorts are in receipt of orders for 20 Britannias, comprising seven 300s for B.O.A.C., four 314s for Canadian Pacific, three 252s for the Ministry of Supply and six 253s for R.A.F. Transport Command. The last three versions are all of the extra-long-range type, the 250-series being mixed passenger/freight aircraft with large cargo doors. The 252s will, in operation, be employed on trooping contracts by three independent airlines. The 253s replace the V.1000 programme.

The upper photograph illustrates the first B.O.A.C. Britannia 300. When this flies in October it will be the first production 300, and deliveries are scheduled at one per month thereafter. The mixed-traffic machines continue at the same rate from the summer of 1957. Production potential exists for two aircraft per month after completion of the first 16. At the present time over half the airframe is made outside Belfast, but Shorts expect to be completely self-sufficient by the end of the year. They have also done a great deal of Britannia design work (such as the structural side of the 300-series electrics) and have designed, and will manufacture, all the long-range, integral-tank outer wings for Britannias built at Belfast and Bristol.

Also visible in the heading picture are portions of G-ANBA and BB, the first two Filton-built production Britannia 100s for B.O.A.C. Both were flown up to Belfast to be completely refurnished and delivered to B.O.A.C. in full operational trim.



There are two final erecting shops at Hurn, each capable of accommodating 12 Viscount fuselages. That illustrated (right) is devoted entirely to the production of V.745s for Capital Airlines.

VISCOUNT ROUND-UP

News From Three Aspects—Operations, Production and Development

ADDRESSING the 24th annual meeting of the Institute of the Aeronautical Sciences on January 24th, Mr. J. H. ("Slim") Carmichael, president of Capital Airlines, outlined broadly his company's experience of the Viscount during its first months of regular operation in the United States. Mr. Carmichael paid several tributes to the aircraft in the course of his address, but one remark stands out as being especially quoteworthy; Capital, he said, had placed the Viscount into service without experiencing a long or even a short period of adjustment—"Operations have been as normal as though we had been flying these airplanes for the past five years."

"The Viscount," Mr. Carmichael went on, was "a far better piece of equipment than we had ever anticipated." Other than routine checks, maintenance work on the Viscount was not done out on the line as it historically had been done, and overnight checks had been practically eliminated. That work was done in Capital's main shop at their Washington headquarters; engine run-ups were every 100 hours instead of at the beginning of each day's operations.

Earlier, Mr. Carmichael had reviewed the effect of the Viscount's introduction on the American travelling public, which, he said, had again proved its "hunger for continuing technological progress." Capital's purchase of a British product—admittedly developed by two of the greatest names in the annals of aviation history, Vickers and Rolls-Royce, but nevertheless a product of another country's industry—had tested the universality and statesmanship of the aeronautical sciences. Mr. Carmichael told his audience: "The vision of those in your field who recognized that Capital was not engaged in playing at diplomacy but had purchased the Viscount as hard-headed businessmen, aware that here was a sound development of the next logical step in air transportation, is best evidenced by the orders for new transport aircraft, which today total over one billion dollars. Here again is testimony that technological progress creates its own markets. . . . I honestly believe the inauguration of Viscount service moved the timetable by at least a year to eighteen months."

When Capital announced their Viscount order they had received thousands of favourable letters from the public. Only eleven people had written critical letters, and eight of these had withdrawn their criticisms on receiving Capital's answer.

Mr. Carmichael qualified his remarks by saying that only nine of Capital's 60 Viscounts were as yet in service. Even so, they were operating 3,600,000 seat-miles weekly at a load factor only a point or so below the "low eighties" experienced in the first weeks of operation. This could not be explained away by the novelty value of the Viscount—"there are not enough novelty-seekers among air travellers to sustain a high load factor"—but rather by its inherent passenger appeal, which not only attracted passengers but made them confirmed Viscount travellers once they had experienced a ride in it. Passengers were aware of the turboprop and interested in learning about it; seven printings had already been made of an explanatory booklet prepared by Capital on the turboprop and the demand for it had not yet slackened.

Already the Viscount was securing for Capital the dominant position on one of their most important routes. From February there would be six non-stop Viscount flights daily between the two major cities on that route, compared with the pre-Viscount frequency of two non-stop flights per day. Meanwhile, Capital's main competitor had reduced his frequency on this route from five to four flights daily and had "removed his top-notch equipment to another market." In an oblique reference to the 365-m.p.h. DC-7, Mr. Carmichael recalled that the Viscount, in its first major competitive effort, "was pitted against the fastest and most modern piston-engined airplane. Its published operating schedule was

Viscount EI-AFY "St. Brendan", illustrated at Dublin Airport, displays the distinctive new colour scheme of Aer Lingus. The cabin-top and fin, previously unpainted, are finished in Winchester green, and the cockpit-top colour is quoted as "English green". The fuselage flash is white.

Before returning to Wisley from its recent tropical trials, the Viscount 700 called at Addis Ababa for a demonstration before Emperor Haile Selassie, who is seen in the foreground of the left-hand view. Behind the Emperor may be glimpsed A. Cdre. Legg (Rolls-Royce, South Africa), and Mr. Colin Allen, Vickers-Armstrongs test pilot; speaking with the Emperor is Mr. J. M. Montgomery, Viscount development engineer.

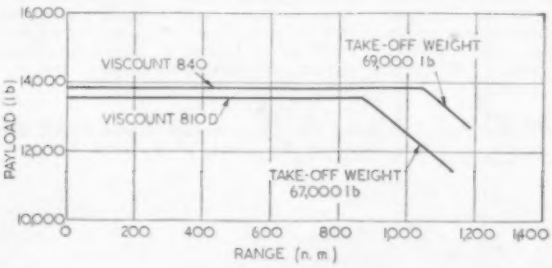
identical with theirs and I can now disclose that it has met that schedule with ease." Two other important points made by Capital's president were that in the 25,000 hours accumulated to date with Rolls-Royce Darts there had not been a single engine failure, and that there had never been any thought of requesting take-off or landing priority for the Viscount at U.S. airports.

Finally, said Mr. Carmichael, "all the aspects we have discussed so far would be immaterial if the Viscount did not put black ink on the ledger. . . . The Viscount is meeting that all-important yardstick." Costs were amazingly close to Capital's estimates.

It was reported recently that Capital Airlines had placed an order for 30 more Viscounts, increasing their total purchase to 90 aircraft. No such contract has in fact been signed, though the fact that Mr. Carmichael is due to visit Weybridge shortly suggests that a repeat order is at least possible.

At the time of writing, the number of Viscounts sold by Vickers-Armstrongs totalled 274, of which 90 had been delivered. Viscount customers totalled 30, comprising 24 airlines, three Governments and three private companies. Negotiations now in progress concern new customers as well as repeat orders from existing purchasers, and it is believed that at least one more firm order will be announced before this issue of *Flight* appears.

Operators who have now taken delivery of Viscounts include B.E.A., Air France, Aer Lingus, T.C.A., T.A.A., B.W.I.A., the Canadian and Indian Governments, Middle East Airlines, Iraqi Airways and Misrair. The first of the three Viscounts ordered by the Venezuelan airline L.A.V. is about to fly at Hurn, where the Venezuelan aircraft are followed on the assembly line by Viscounts for Central African Airways and T.C.A. The other line at Hurn is entirely occupied with Viscount 745s for Capital Airlines, whose tenth aircraft, incidentally, is now flying. This Viscount is the first to be powered with Dart 510s, and is thus the first of the faster, more powerful V.700D family.



Payload-range curves for the new versions of the Viscount 800 referred to above. Zero wind and I.S.A. conditions are assumed, and fuel allowances include two hours' holding at 10,000ft on four engines.

At Weybridge, where new erecting shops have lately been completed, work is currently proceeding on Viscounts for T.C.A., the Pakistan Government and for Compania Cubana de Aviacion (who have bought the aircraft originally ordered by Airwork). Later this year production resources at Weybridge will be turned over to the V.800 Viscount Major series, the first of which is due to fly in the summer. Hurn will then be responsible for building all V.700 aircraft, as well as V.800 fuselages, which will be moved to Weybridge by road for final assembly in the parent factory.

The Viscount Major, it will be recalled, was originally developed for service on B.E.A.'s high-density, shorter-range routes. Subsequent development of the Rolls-Royce Dart has made it possible for Vickers-Armstrongs to offer the V.810D and, later, the 840, which will feature not only the larger cabin of the basic V.800 but also a range comparable to that of the V.700 and a considerably higher cruising speed. Powered by Dart RDa.7/1s, the Viscount 810D will have a cruising speed of 363 m.p.h.; installation of Dart RDa.8s will convert the 810D to the 400-m.p.h. Viscount 840. Their higher cruising speed, coupled with the ability to carry 65-70 passengers over stages of around 1,000 miles, makes these new versions of the Viscount competitive with the Electra—particularly in the case of medium-range/medium-traffic operators. Delivery of 810Ds to Continental Air Lines, first purchaser of this mark of Viscount, is due in March 1958, with conversion to 840s scheduled for the following year.

Both the 810D and 840 have, of course, been structurally designed for higher speeds at all altitudes than present Viscounts, and for greater gross weights. To assist in development of the "400-m.p.h. Viscount," the V.700 prototype, G-AMAV, is about to begin a programme of trials involving noise measurements and control assessments at high speeds. At light weight, and with all four Dart 510s at full power, this aircraft is capable of over 400 m.p.h. It will later be fitted with the new horn-balanced elevators and rudder developed for the V.800.

ROYAL AERO CLUB AWARDS

THE Britannia Challenge Trophy for 1955 has been awarded to Capt. J. W. Hackett and Mr. P. J. Moneypenny, crew of the Canberra PR.7 which made the one-day out-and-return flight from London to New York on August 23rd, 1955. Other awards announced by the Royal Aero Club are as follows:—

Geoffrey de Havilland Trophy.—Capt. J. W. Hackett, for the New York to London record of 550.35 m.p.h. set up on the above date.

Royal Aero Club Gold Medal.—Mr. John Cunningham, D.S.O., O.B.E., D.F.C., chief test pilot of the de Havilland Aircraft Company, "in recognition of his work in connection with British aviation."

Royal Aero Club Silver Medal.—S/L. J. S. Fifield, D.F.C., A.F.C., "in recognition of his personal courage displayed in testing the automatic ejection of pilots from aircraft at ground level (September 3rd, 1955) and at 40,000ft (October 25th, 1955), which will have great influence on the future safety of pilots."

WORMWOOD SCRUBBED?

HOPES for the use of Wormwood Scrubs—an open space near the centre of London—as a terminal for Twin Pioneer operation by Scottish Airlines (*Flight* for January 27th) dwindled last week when the voice of the London County Council was raised. Mr. I. J. Heywood, leader of the Council, stated: "There is no possibility of using even part of the Scrubs other than as an open space unless amending legislation [to the Wormwood Scrubs Act, 1879] were passed . . . I feel it is only right to add that the L.C.C. would feel bound to oppose the proposal." Mr. Heywood made it clear that the L.C.C. is not opposed to air services linking city centres, but pointed out that London's public open-space needs are vital, with so much more still to be done in the drive towards the target for London's development plan.

HERE AND THERE

Netherlands-U.S.A. Link

AFTER an 18-day tour of aviation establishments and factories in the United States, Prince Bernhard of the Netherlands has returned to Holland. The Dutch Radio has reported that an "aviation treaty" between Holland and the United States is likely to be negotiated in the near future.

Pioneer Engine-builder Dies

THE designer and builder of the four-cylinder engine used by the Wright Brothers on their first powered flight, Mr. Charles Edward Taylor, has died in hospital at San Fernando, California, at the age of 87.

Desert Sighting

A CONVOY of ten R.A.F. lorries, which had become bogged down through heavy rain in the Arabian Desert whilst they were carrying R.A.F. Regiment stores from Akabe to Amman, was located by R.A.F. aircraft after the vehicles had been missing for three days, during which time the crews had been without food.

Ice-cream Waver

AT Barnet last week a fine of £20 was imposed upon the pilot of a light aircraft, who had been summonsed for flying over Potters Bar at under 1,000ft and flying without a licence. It was said in evidence that the defendant, a former ice-cream salesman, flew low in order to wave to the driver of an ice-cream van.

The Balloon War

THE latest allegation in the "balloon cold war" is a claim by the East German Government that big balloons carrying up to a ton of "complicated technical equipment"—aerial cameras and radio transmitters—have been found in East Germany. Stating that the balloons were of U.S. manufacture, the Government Press Office said that they constituted a serious danger to air traffic.

NO SPACE SHIP, but a special V.T.O. test rig for a S.N.E.C.M.A. Atar turbojet. The engine is housed in a nacelle mounted on gimbal rings to give freedom about all three axes. Its motions are at present remotely controlled, but a pilot will ride on the rig at a later date.

Penalty

"THE chairman of the San Lorenzo [Argentine football] Club, Senor Luis Traverso, said later that Sanfilippo would be sent home by air today as a punishment"—*Daily Mail.*

Vampire Trainer in Japan

THE Japanese Air Defence Force has taken delivery of a de Havilland Vampire T.55 Trainer. It will be evaluated at the training base at Hamamatsu.

B-66s Delivered

TACTICAL Air Command of the U.S. Air Force is now receiving Douglas RB-66 twin-jet reconnaissance machines. These high-subsonic aircraft are derived from the Navy A3D Skywarrior, but have more fixed equipment and shorter range. Considerable difficulties have delayed deliveries by some nine months. Although Allison power the B-66 (with their J71-A-9 turbojet), General Electric supply the computing system for the fire control (two 20 mm guns) and the paralleled alternating-current electric system.

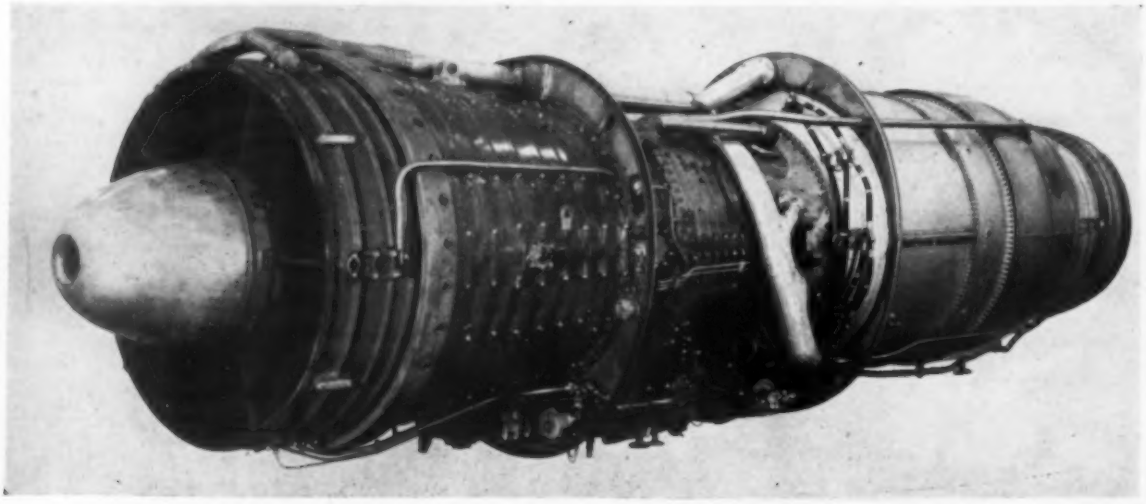
R.A.F.A. Belfast Display

THE Northern Ireland headquarters of the Royal Air Forces Association has announced that its annual display at Royal Naval Air Station Sydenham, Belfast, will be held this year on June 9th. R.A.F. and NATO support is hoped for.

Long-distance Lightweight

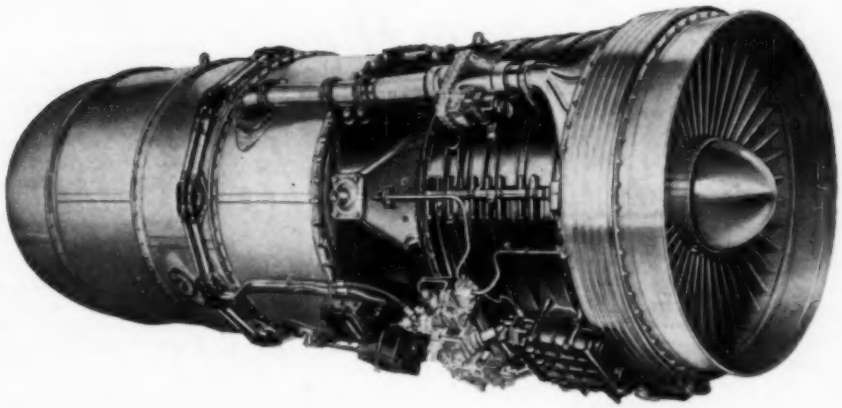
FLYING a Cessna 180 (225 h.p. Continental), Capt. William Judd, a civil airline pilot, attempted on January 30th a non-stop flight from White Plains, New York, to Rome, with a possible continuation to Cairo. Eventually, meeting difficult weather, he landed at Toussus-le-Noble airfield near Paris, after 24 hr 11 min.

NEW OLYMPIC HEIGHTS: Four Bristol Olympus BOl.11s, as depicted here, are capable of giving the Vulcan medium bomber 48,000 lb of thrust. The new engine (see news item, p.152) can be distinguished from its predecessors in having five, instead of six, intake struts.



HIGH THRUST · LIGHT WEIGHT

LOW CONSUMPTION



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Provision is made on the Temco Model 58 trainer for the external loads shown, though they are not carried simultaneously. The loads are: two napalm tanks, two 100 lb G.P. bombs and sixteen 8cm rockets. Built-in armament is two 0.5in or 0.3in machine guns.

AIRCRAFT INTELLIGENCE

U.S.A.

Boeing B-52 Stratofortress. The U.S.A.F. announced in Washington that it would begin this April to replace Convair B-36s of Strategic Air Command with Boeing B-52 Stratofortresses. Some 400 B-36s were built and 500 B-52s will have been completed by the end of 1958, according to present schedules. A speed of 650 m.p.h. has been mentioned for the B-52.

Lockheed C-130. One of these new turbo-prop transports has been delivered to Eglin Air Force Base, Florida, for testing at sub-zero temperatures in a special giant hangar, wherein it will remain for several months. The purpose of the tests is to determine the effects of extreme cold on the functional and operational components and systems. Another item of Hercules news is that Aeroproducts airscrews have been selected for the type.

Beech XKDB-1. This is a new target drone, powered by a supercharged piston engine, having a straight wing with tip-mounted tanks, and a "butterfly" tail. It is designed to float to facilitate recovery.

Canada

Canadair CL-28. By the end of the year this maritime-reconnaissance development of the Bristol Britannia should be ready for flight. The initial R.C.A.F. order calls for 13 machines.

Doman-Fleet LZ-5. Production will soon begin at Fort Erie, Ontario, of the LZ-5 seven-passenger helicopter. An approved type certificate should by now have been received by the Federal Transport Department. Thus, Doman-Fleet will become the first Canadian company to manufacture helicopters in quantity.

France

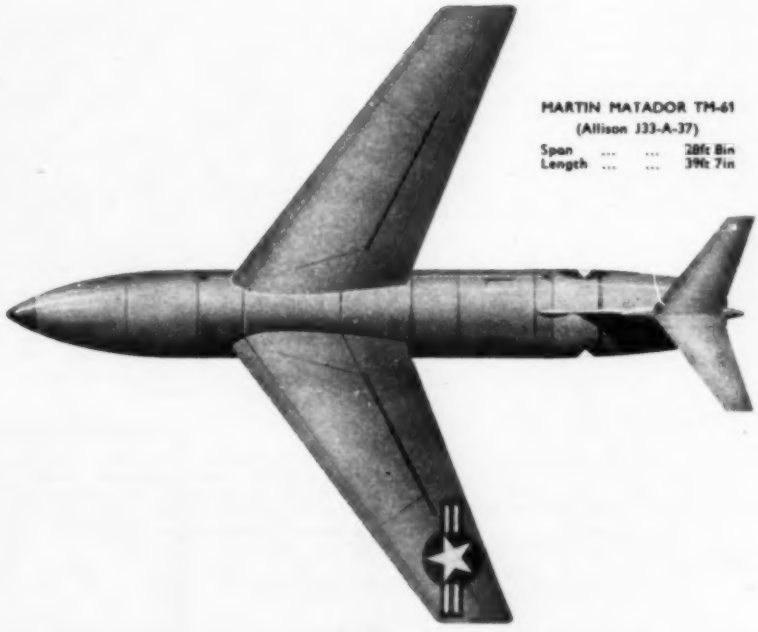
S.N.C.A.S.O. Trident II. After a flight at Istres on January 5th, one of the Trident II prototypes was forced to land, apparently without power, off the runway. The aircraft was damaged but the pilot, Jacques Guignard, was uninjured.

S.N.C.A.S.O. 4050 Vautour. Armament and auxiliary-tank loads of the Vautour have just been disclosed as: two large, external, jettisonable, under-wing tanks, replaceable by "honeycomb" rocket launchers in the outboard positions; two honeycomb rocket launchers with 38 rockets each inboard under the wings; a "pack" of four 30 mm guns with 400 rounds, or 240 rockets in a magazine. The total number of Vautours now on order is 140, including ground attack, all-weather fighter and light bomber versions.

Max Holste M.H.1521 Broussard. Success in the civil and military markets has prompted Avions Max Holste to expand its programme for production of the six-passenger Broussard. The type is now in full production at Rheims, and certain components are being built by the S.I.P.A. and S.E.C.A. companies. Rate of output is at present two aircraft monthly, but this will increase to ten monthly by the end of the year. In all, 215 military and civil Broussards are on order. It has lately been disclosed that the President of the Argentine Republic has signed an order for ten of these machines to be operated by the Argentine Ministry of Agriculture. They will go into action against the grasshoppers.

U.S.S.R.

Tu-104. The designation Tu-104 has been mentioned by General Nikita A. Sakharov, Russia's Director of Civil Aviation, for the new Soviet twin-jet transport shortly to be introduced into service. The general credited the aircraft with a speed of 500 m.p.h. at heights exceeding 36,000 ft.



MARTIN MATADOR TM-61
(Allison J33-A-37)
Span 28ft 8in
Length 39ft 7in

SUBSONIC TO HYPERSONIC

An Outline of Problems to be Faced and Overcome

ENTITLED *Problems of High-Speed Flight*, a lecture was read on January 30th before the Derby branch of the Institution of Mechanical Engineers by Mr. R. F. Creasey, an assistant chief engineer of English Electric's aircraft division. Though he ranged over the entire spectrum of high-speed Mach numbers, Mr. Creasey devoted most of his attention to the supersonic regime. He made several references to his own company's *magnum opus*, the P.1, and also let fall several comments which are not inapplicable to the very different Lockheed F-104. Below is the first of two instalments summarizing the paper.

High speed, said Mr. Creasey, was a relative term. To "stick, wire and fabric pilots" of 50 years ago 150 m.p.h. appeared an almost impossible prospect. Today it was below the speed at which many aircraft would take the air.

In the first sections of his paper, the lecturer reviewed the onset of "high-subsonic" troubles which arose as Mach numbers were increased well above 0.5; in particular, the design of the Canberra, with thin, unswept wings, was examined by the lecturer in some detail and compared with possible alternatives. Large changes in pitching moment required either a long tail moment arm or —in the case of a "tailless" machine—large elevons which, at high deflection, significantly increased drag. It could be that tail-first designs might be worth studying.

When high-subsonic aircraft were cruising just below their critical Mach number most of their drag was in the form of skin friction. Particularly at high altitude (Fig. 1) it was worth trying to achieve laminar flow over much of the wing. Provided reasonable care was taken with the design and manufacture of the wing, theory suggested that it needed only favourable pressure gradients to ensure extensive laminar flow. Pressure plotting of the Canberra wing showed such a gradient to be present over most of the lower surface and also, at the desired cruising conditions, over the most important part of the upper surface (Fig. 2). The latter was actually present only when sufficiently near the design Mach number for there to be a region of supersonic flow; the strength of the shock wave (near mid-chord) was insufficient to offset the advantage from laminar flow.

The drag rise beyond the critical Mach number—in a subsonic design—was very rapid and continued up to at least Mach 1. This had not, however, prevented a number of subsonic designs from diving to speeds near (or even slightly beyond) the speed of sound. The intrepidity of the test pilot had thereby revealed a whole crop of dangerous handling problems, some of which could be cured only by introducing supersonic design features incompatible with subsonic efficiency.

Longitudinal trim changes were particularly important, and the most dangerous were those which occurred at low altitudes. Straight-wing aircraft with considerable camber were particularly bad at low angles of attack such as were associated with low-altitude flight. The introduction of symmetrical wing sections took most of the violence out of these problems. Another well-known phenomenon was the "shock-stall" limit of a thick-wing aircraft, which merged into the low-speed stall on a continuous curve of limiting-g against Mach number (Fig. 3). This limit occurred not only at relatively low Mach numbers but was completely impenetrable, owing to heavy buffeting, violent wing-drop or longitudinal trim changes.

As sweep-back was increased or as thickness/chord ratios were reduced this limitation was eased; and, more important still, the various associated phenomena became less severe until the experienced pilot could venture beyond the limit in a dive. If the wing were made sufficiently thin and swept, most of the "limitations" could be removed up to very high angles of attack at all Mach numbers, as shown by the upper curve in the diagram.

A good pilot could often negotiate mild trim changes and instabilities, provided he had full control. The conventional trailing-edge surface lost considerable effectiveness at supersonic speeds (Fig. 4), and, over a small range of deflections, the control might become completely ineffective at high subsonic speeds. This could be prevented by making the trailing angle very small, either by making the surface very thin or by giving it a blunt trailing edge. The effectiveness was then normally sufficient provided the hinge line was not highly swept. Maximum rolling effectiveness could be maintained only by keeping the ailerons near the tips and reducing the sweep of the hinge lines. Any further improvement from moving the complete wing-tip was not usually justified, since a more serious limit on manœuvrability was set by loss in elevator effectiveness. Nevertheless, rotating the complete tailplane, or foreplane, could give very effective control at all Mach numbers provided the surface was thin and moved by an irreversible powered circuit.

Other things being equal, stick forces increased as the cube of

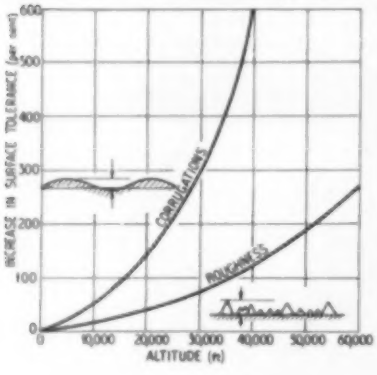


Fig. 1 (left). Effect of altitude on the maximum surface-tolerance which can be accepted without disturbing the boundary layer. A marked relaxation in tolerance is permissible on high-flying aircraft.

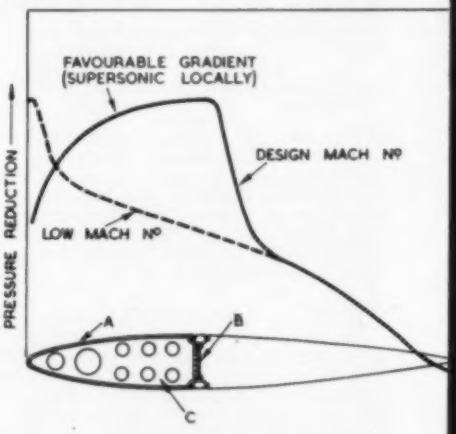


Fig. 2 (right). Pressure plot of the Canberra wing at C_L=0.3. Area A comprises the forward section of the wing with continuous wrapped-around skin ahead of the spar B, stabilized by many close-tolerance ribs C.

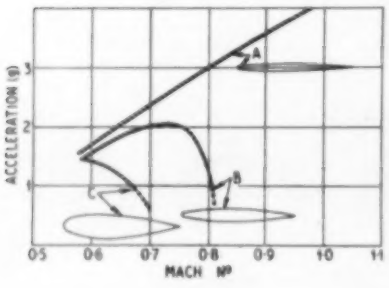


Fig. 3 (left). Limitations on Mach number at high altitude: A is a true supersonic design, B is a wing typical of a long-range, high-subsonic aircraft and C is a typical low-speed wing (actually N.A.C.A. 23021).

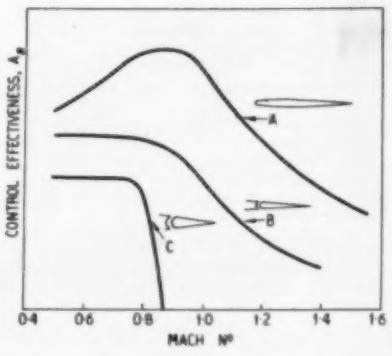
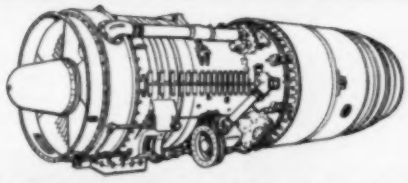


Fig. 4 (right). Effect of compressibility on the effectiveness of typical control surfaces: A is a thin, all-moving "slab"; B is a conventional surface with small trailing-edge angle and C is a surface with a large trailing-edge angle.

THE *FAIREY* DELTA 2



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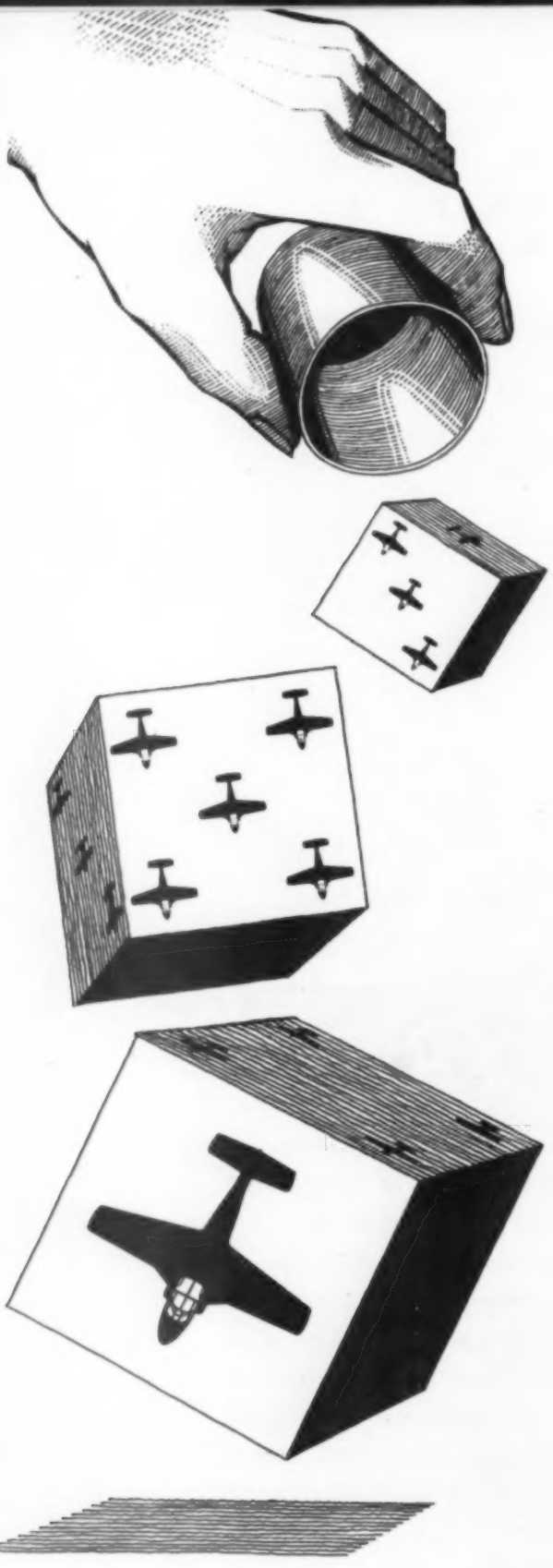
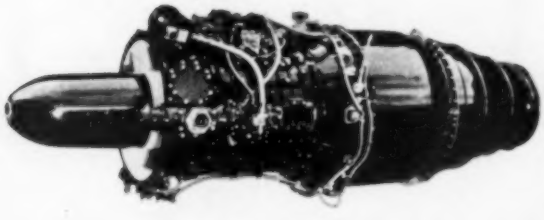


Luck is no ally...

We do not like good luck. In fact, we take considerable care that it plays no part in the evolution of our aircraft engines. Only by testing, re-testing and testing again, only by total elimination of the chance factor has the success been assured of such engines as the Viper turbojet, power plant of Britain's first basic jet trainer.
And only by applying the same relentlessly methodical approach to the further development of these proven types can their great potentialities be fully realised to advance Britain's progress in the air.



ARMSTRONG SIDDELEY AERO ENGINES

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SUBSONIC TO HYPERSONIC . . .

the linear dimensions of the control surface and as the square of the indicated airspeed (or more at transonic speed), unless the control was extremely closely balanced aerodynamically. The introduction of spring or servo tabs extended this tolerance to larger aircraft and higher speeds; but, owing to much-reduced tab effectiveness, this solution could not be extended to the supersonic regime. The basic hinge moments increased so much at supersonic speeds as to invalidate all normal methods of aerodynamic balancing, unless the aircraft were very small and limited to functions in which large and irregular stick forces were acceptable.

The lecturer went on to state that powered controls were therefore essential on supersonic aircraft. Power-boost was only an interim solution and the best arrangement was the completely powered system, made as irreversible as possible. A certain degree of aerodynamic balance was desirable to reduce the dimensions of the mechanical system, but the problem was now mainly one of duplication and reliability.

Longitudinal instability (and its converse, excessive longitudinal stability, or unmanœuvrability) was difficult to eliminate. Generally speaking, the straight wing tended to become unstable in normal flight at high subsonic speeds before becoming unmanœuvrable at higher angles of attack. The instability was worsened by increase in trailing-edge thickness and aspect ratio, and also by aeroelastic effects. In contrast, the swept wing tended to become unstable at high angles of attack at subsonic and transonic speeds if the aspect ratio were made too great. The phenomenon was associated with tip stalling and could sometimes be reduced by modification near the leading edge. On the other hand, the resulting pitch-up could become dangerous if the tailplane were mounted above the level of the wing (where downwash magnified the instability). Careful design of an aircraft with a swept wing of moderate aspect ratio and a low tailplane could result in a progressive increase in stability from subsonic to supersonic speeds. The control system could then be designed to give maximum manœuvrability at all speeds.

Turning to the problems associated with transonic drag rise, Mr. Creasey remarked that, to be of lasting practical value, supersonic flight had to be reached in level and climbing flight and maintained for much longer periods than at present. Rocket boost had been valuable in the past in combating the increased drag, as also had been afterburning, but four times the supersonic duration could be achieved if the required thrust was available without the use of any form of augmentation. The English Electric P.1 could climb supersonically without afterburning, and such performance was possible only by carefully reducing the wave drag. At this point Mr. Creasey began a careful exposition of the area rule.

[This subject has already been extensively discussed in our issues of September 30th, 1955, November 18th, 1955, and—with particular reference to the English Electric P.1—December 2nd, 1955. The latter article was referred to by Mr. Creasey when he stressed the fact that his company's fighter was the first design fully to comply with area rule without exhibiting any obvious excrescences or other modifications.]

Drag due to lift (Fig. 5) was also of great importance, continued the lecturer, particularly for a supersonic fighter manœuvring at high altitude. For low-speed wings induced drag depended on aspect ratio as well as wing loading; in supersonic flight aspect ratio became of decreasing importance, since the wing tip could influence only that portion of wing inside the Mach cone from its leading edge. Reduction in aspect ratio was limited mainly by low-speed considerations, and this was true even of low-aspect-ratio wings with sharp leading edges, where flow separation caused almost complete loss of leading-edge suction.

This more than doubled the drag due to lift, compared with a well-rounded leading edge on a wing of similar plan form. The potential advantage of the highly swept leading edge was its ability to generate suction up to moderate supersonic speeds, provided the tip sections were properly rounded over the leading edge.

If a wing were designed for cruising at high supersonic speeds there was no longer any intrinsic value in sweep-back and a return was possible to more rectangular wings, but of very low aspect ratio. Sharp leading edges were preferable, and bi-convex sections gave a lower drag than simple wedges for any assumption of structural strength or volume, unless a large depth at some point was essential. Taper would be structurally advantageous and, rather curiously, final choice might again depend largely on constructional or layout compromises just as it did before the compressibility era. This was, however, true only insofar as it allowed surfaces to be as thin as possible; the trend towards lower aspect ratios, greater taper, and higher wing loading would all help in achieving this objective in minimum weight. Another point made by Mr. Creasey was that it was always important to do tunnel testing of any configuration over its complete range of Mach number, incidence and sideslip.

This trend towards much smaller wing volumes was such that the shape and drag of the fuselage became of major importance. The increase in Mach angle to 60 deg at M=2 and 70.5 deg at M=3 would also make the shaping of the body less locally dependent on other surfaces than the *transonic* [our italics] area rule suggested. The drag relationship between various types of slender bodies [already illustrated by the lecturer] remained true over a wide range of speeds, and Sears-Haack, or similar forms, were still the best until Sänger's flat-bottomed shapes came into their own at hypersonic speeds.

Since wave drag decreased rapidly with increase in fineness ratio much longer fuselages should be used on aircraft which spent most of their time supersonic. In fact the process could be continued until the skin friction was double the wave drag. In practice the optimum length would be much less, due to increase in structure weight (unless extra length was needed as a moment arm or for stowage). On a fighter it was worth remembering that the extra skin friction was always present, whereas the saving in supersonic drag was important only momentarily. This was not true for the long-range supersonic aircraft, where it was also likely that increasing the volume available for fuel would be more important than achieving minimum cross section. Minimum drag was then obtained by increasing fuselage length still further (decreasing cross section accordingly) until the skin drag was eight times the wave drag. Practical factors again dictated a lower fineness ratio, but some part of the problems resulting from high fineness ratio would have to be accepted in the long-range supersonic aircraft.

Skin friction might therefore regain much of the importance

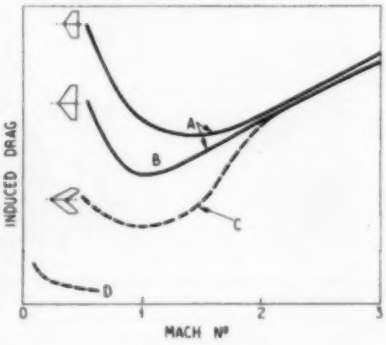


Fig. 5. Drag due to lift of high-speed wings at the same altitude and acceleration: A and B are wings with sharp leading edges with respective aspect ratios of 2 and 3; C is a slightly swept wing with a well-rounded profile and D is a low-speed design.

that it had at subsonic speeds. The possibility of laminar flow at supersonic speeds was suggested by the fact that the favourable effects of pressure gradient and altitude could be made particularly advantageous. In addition, theory indicated that heat transfer into the skin was a powerful method of helping to stabilize a laminar boundary layer at moderate supersonic speeds, and surface cooling might therefore prove very significant. On the other hand, if turbulent flow occurred it always increased skin temperature and this in turn reduced the skin-friction coefficient—but not to the values for laminar flow.

The next section of Mr. Creasey's lecture was concerned with the problem of range at supersonic speeds. It could be shown that the maximum range of an aircraft depended on the overall propulsive-system efficiency, aerodynamic efficiency (lift/drag ratio), and of the fuel calorific work-value per pound of aircraft weight. Assuming 10,500 C.H.U. per pound of fuel, when the aircraft started its cruise carrying fuel equal to half the gross weight, then range could be expressed as: (1,690 L/D η_p) where L/D was the lift/drag ratio and η_p the propulsive efficiency. Deterioration in lift/drag ratio at transonic speeds caused a large fall-off in maximum range, but at higher speeds the overall propulsive efficiency improved, so bringing the attainable range back almost to that attainable at subsonic speeds.

Nevertheless, the assumption that half the aircraft weight could be carried in fuel was emphasized. This required the usual rigorous control of structure and powerplant weight such that the efficiencies were practical compromises and not peak values. Moreover, at supersonic speeds the volume of fuel would also compromise L/D, owing to the effect on wave drag. Although values of L/D exceeding 20 had been attained in a number of subsonic designs, the ratio fell away above M=0.8, eventually stabilizing at a value of about six (at around M=1.5) decreasing very slowly with further increase in Mach number.

Overall propulsion efficiency was the product of thermal, mechanical and propulsive efficiencies. The efficiency of airscrew systems fell off very rapidly at high subsonic speeds, whereas

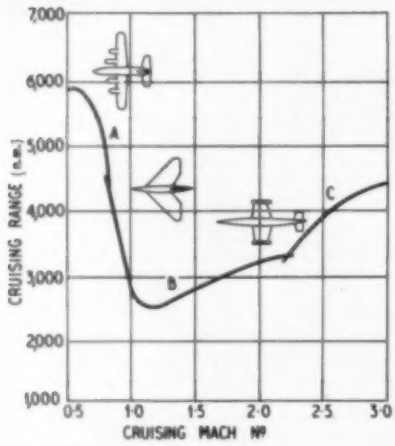


Fig. 6. Maximum cruising range for different species of aircraft at their design Mach numbers: A is airscrew driven, B is turbojet-powered and C is ramjet-powered.

SUBSONIC TO HYPERSONIC . . .

turbojet efficiencies continued to increase up to Mach numbers of at least 2. If high-efficiency multi-shock intakes and convergent-divergent nozzles were used this improvement could be maintained up to a Mach number of nearly 3 with the turbojet and to at least 4 with the ramjet.

Ranges calculated from the above assumptions could be plotted against design Mach number (Fig. 6). It was obvious from this curve that really long ranges were quite out of the question at transonic speeds, whereas increase in Mach number brought a progressive recovery in range up to the highest speed at which the aircraft could fly in the face of aerodynamic heating. Even greater ranges were possible at hypersonic speeds if the problems of aerodynamic heating were reduced by flying in the outer reaches of the atmosphere. This, however, introduced completely different problems. Meanwhile, ranges at lower speeds could be improved by various detail refinements; if the expense were justified even greater improvements were possible with new fuels, both chemical and nuclear.

Long-range supersonic flight would require extreme concentration on one design Mach number, since over 90 per cent of the flight would be carried out at this Mach number. In contrast, the present supersonic fighter might fly 90 per cent of its time at subsonic and transonic speeds, requiring considerable compromise over a range of Mach numbers.

The design of supersonic aircraft involved balancing important factors which interacted very considerably. As a result, the primary designers had to have a better appreciation of the overall problems than had been possible under present organizations, where the powerplant and equipment had been designed separately to equip a number of different specifications. Even if some items found applications in aircraft with less performance the design would initially have to be based on the aircraft with the greatest performance. This process of integrated design had always existed for guided weapons. In the aircraft industry the main problem was one of personnel reorganization and training.

Turning to the more technical problems of stability and control, said the lecturer, the importance of characteristics at lower speeds could not be overlooked, since the aircraft would have to fly through the complete range of Mach numbers at each end of every flight. An ideal design for high supersonic speeds was unlikely to have very good take-off and landing characteristics, and would not necessarily be satisfactory at transonic speeds. This might mean that a considerable part of the initial design period would be spent in making these characteristics safe without undue prejudice to the cruising performance. Stability and control at the design cruising speed had to be perfected to a much greater extent. If the c.g. were kept near to the position required for take-off and landing, most longitudinal instabilities disappeared at high supersonic speeds. However, unless the c.g. were controlled, the problem was likely to be the inverse one of trim drag owing to an excess of longitudinal stability.

Lateral stability was a more delicate balance of aerodynamic forces and might require more attention over the full range of Mach numbers. The highest attainable speeds would be employed only at extreme altitude and, as a result, damping and response effects would be abnormal about all axes. This exaggerated the importance of inertia forces compared with aerodynamic control forces; unless the pilot/servo could accustom himself to the new state of affairs it would be essential to complicate all the controls with autostabilizers or other such devices.

This provided another example of the manner in which aircraft and guided-weapon design principles were converging at high supersonic Mach numbers. Nevertheless, wherever the mission was really complicated the basic unreliability of a completely automatic system would have to be accepted for some time to come. Flexibility of the human element seemed essential for monitoring individual functions (reducing complexity), and to take over or discriminate between functions when elements failed.

The degree of safety required for civil aviation was such that a human crew seemed essential to supplement automatic control as far as the future could be foreseen. This also seemed true of military aircraft where it was essential to return reconnaissance, or other, equipment to its base. Other operations might see a long transition phase where automatics slowly replaced the human functions.

The remainder of Mr. Creasey's wide-ranging paper dealt with hypersonics, thermal heating, superaerodynamics, and the ballistics of rocket flight. This part of the paper will be abstracted in an early issue.

REMEMBERING THE 504

ONE of the most intimate—indeed, exclusive—events in the aeronautical calendar is the reunion dinner of the Avro 504 Club, convened this year at Londonderry House on January 27th. On this occasion the Avro prize apprentice of the year is inducted into the fraternity and, together with his immediate predecessors, sits at table with the great "A.V." himself. Of the select company also are men who worked, themselves as apprentices, on one of the greatest aeroplanes of all time; and principal guests this year were Lord Brabazon and Avro's energetic young general manager, J. A. R. Kay. There was a warm welcome, too, for Frank Buckell, manager of General Electric's aeronautical department and a founder-member of the Sopwith Aviation Apprentices, after the example of which the 504 Club was formed. The presidency of Sir Roy Dobson ensured that the evening went with a swing. As always, the menu card was a joy—a Wren masterpiece alive with sketches acknowledged to J. M. Bruce's history of the 504 printed in *Flight* during 1954.

The organizing of each successive dinner is in the hands of Shell's Joe Taylor and Avro's Philip Kidson, and it was the former who expressed everyone's pleasure at seeing Sir Alliott looking younger than ever. Proposing "The Company," A. Cdre. G. F. Smylie recalled some of his impressions of Avro types, ranging from No. 939, a 50-Gnome Avro requisitioned by the Admiralty in 1914, to the Vulture-engined Manchester. Responding, Sir Roy Dobson had something to say about how Avro were keeping "ahead of the game." No other company in the industry, he said, could hold a candle to them in the matter of scientific equipment, which he instanced by the two existing high-speed tunnels and a third, designed to operate at Mach 3.5, now in prospect. The elaborate test equipment of today he exemplified by the rig for testing Vulcan controls, which had completed 1,500 hr at full load.

Proposing "The Guests," Mr. H. E. Broadsmith said that when he had written "Type 504" at the bottom of his drawings so long ago he little thought the number would become so famous.

Responding, Lord Brabazon spoke in the warmest terms of Sir Alliott's introduction of the classical tractor biplane formula which had dominated aviation for a long period. This type of machine he distinguished from such craft as the Howard Wright, flown by his boyhood friend Tommy Sopwith, and which he described as a slavish copy of the Farman. On this machine, nevertheless, Sir Thomas had made his remarkable flight to Belgium, as a reward for which "he trousered 4,000 Jimmy O'Goblins." Lord Brabazon spoke also of his other friends in the Hawker Siddeley Group, referring especially to "Dobbie" as a dispeller of gloom and one who had four units of personality where the rest of us had one.

With a twinkle in his eye Lord Brabazon went on to consign V. 1000s, DC-8s and Boeing 707s to perdition, deploring that flying had now become aerial transport, devoid of excitement except for the prospect of being burned at the end. On a recent flight he had found a fat lady on each side of him and could not get at his cigarette case. Such travel he described as an insult to one's individuality, and in his opinion the Siamese were better off. Flying in his youth he described as "feeling like sitting on a blancmange in a strong draught." He recalled that he had won the Michelin Trophy at an average speed of 38 m.p.h., and he doubted if anyone could equal this feat today, so little attention having been paid to the lower end of the speed range.

Presenting the Avro 504 Club Trophy to Alan Lawson, the fourth apprentice to receive the reward, Sir Alliott Verdon Roe recalled that he himself had been to Canada when he was 14. He would like to see the company turn out what he described as a "super passenger machine." (Remark from the chair: "So would I.")

Thereafter several of the company were called to their feet, among them Mr. Kay, who warned the newer members against red tape and bureaucracy. If they could not cut through the red tape, he counselled, they should at any rate not allow themselves to be stifled by it.

One of the U.S.A.F.'s two YC-97J turboprop transports which passed through London Airport on a M.A.T.S. route-proving flight to Rhein-Main, Germany, seen starting up and taking off for Germany.

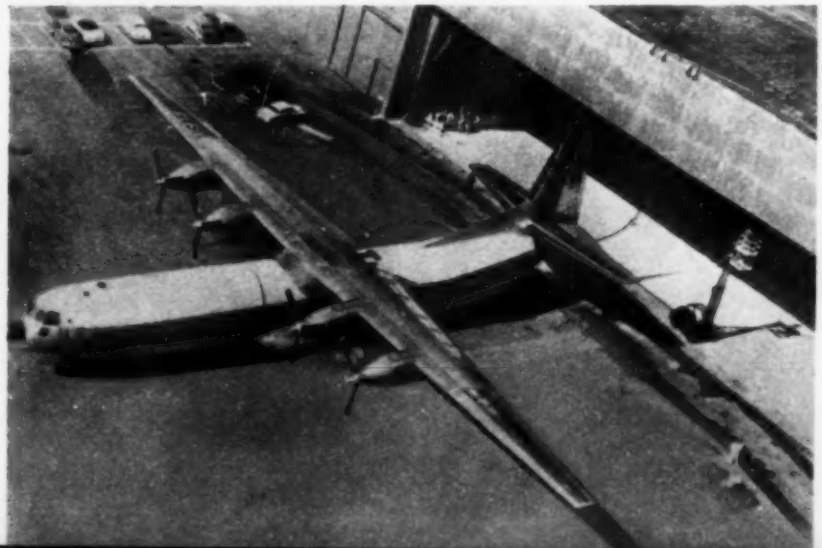
TWO T34-POWERED U.S.A.F. TRANSPORTS

THE first of the two Boeing YC-97J experimental turboprop-powered transport aircraft visited England, passing through London Airport, on the week-end of January 29th. The aircraft is a standard U.S.A.F. C-97 freighter fitted to take four Pratt and Whitney T-34 turboprops giving 6,000 e.h.p. each. Both the YC-97Js are operated by the U.S.A.F.'s 1700th Air Transportation Group at Kelly Air Force Base, Texas, a unit which has the task of evaluating the series of turboprop-powered aircraft delivered to the U.S.A.F. These include two Convair YC-131Cs powered by two Allison T-56s, which have been flying for over two years, and two Lockheed YC-121Fs with P. and W. T-34s which are shortly to be delivered by the makers. In charge of the aircraft which visited London was Col. Claud Smith, who commands the 1700th Group.

The YC-97J is now an operational aircraft and carries no special instrumentation. The U.S.A.F. is using it to build up flying time with the new engines, and operational performance is being simulated by the present M.A.T.S. route-survey flights between Kelly A.F.B. and Rhein Main in Germany. The aircraft crossed the Atlantic from Stephenville, Newfoundland, to Prestwick in 6 hr 4 min at an average speed of 395 m.p.h. with a following wind of 15 m.p.h. This is a record time for the crossing. The YC-97J is the second turboprop type to cross the Atlantic, the first, of course, being the Viscount.

The YC-97J turboprops, which have Curtiss three-blade square-tipped airscrews with scarlet-painted spinners, are started by compressed air. At London Airport the air was supplied by a gas-turbine-powered starter trolley which the aircraft had brought with it. The procedure followed was that the trolley was connected to the aircraft and the turbine run to start No. 3 turboprop. Then the trolley was disconnected, wheeled round to the rear-loading doors and lifted aboard by the aircraft's own gantry hoist. The remaining turboprops were started by taking a transfer bleed from the No. 3 engine. No. 4 started well, but several attempts were required to start Nos. 1 and 2 and the aircraft in fact taxied out to the end of the runway to run up to full power before starting the last engine. Such difficulties are simply due to the starting-air ducts in this installation being a little small for the job. When all its engines were running the YC-97J got away to a remarkably quiet and quick take-off. The ground run lasted some 12 seconds. The aircraft was probably not flying at full load, although it was carrying 21 people and, among other equipment, the ground-starter.

According to inscriptions on the nose of the aircraft the T-34 uses JP-4 fuel (wide-cut gasoline) to specification TO-06-5-1. No precise information was available on the spot about the handling of the engines or the cruising technique. Operating altitude, however, according to the length of the flight, is generally between 25,000ft and 35,000ft.



Received from Long Beach, California, as we go to press, is this "roll-out" picture of the first Douglas C-133A. This 255,000-lb machine is the only production application of the T34 engine. We expect to make further reference to this impressive transport in our next issue.

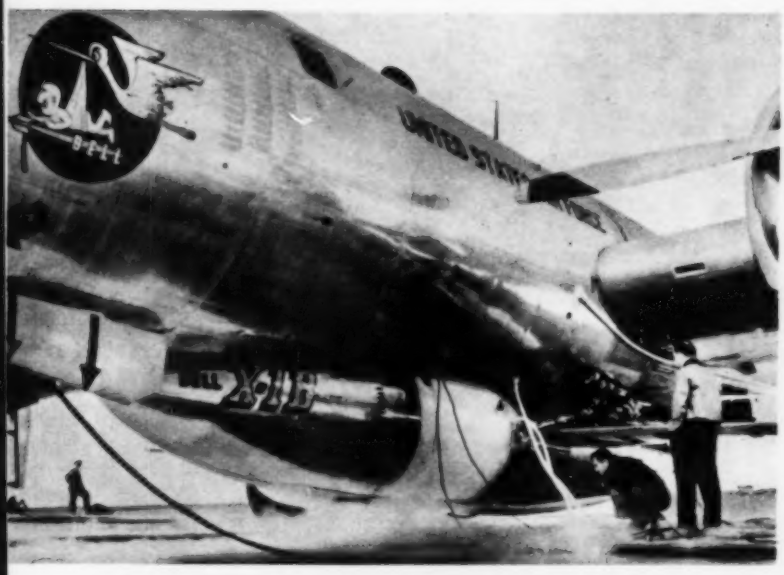
MEN, ROCKETS AND SPACE RATS

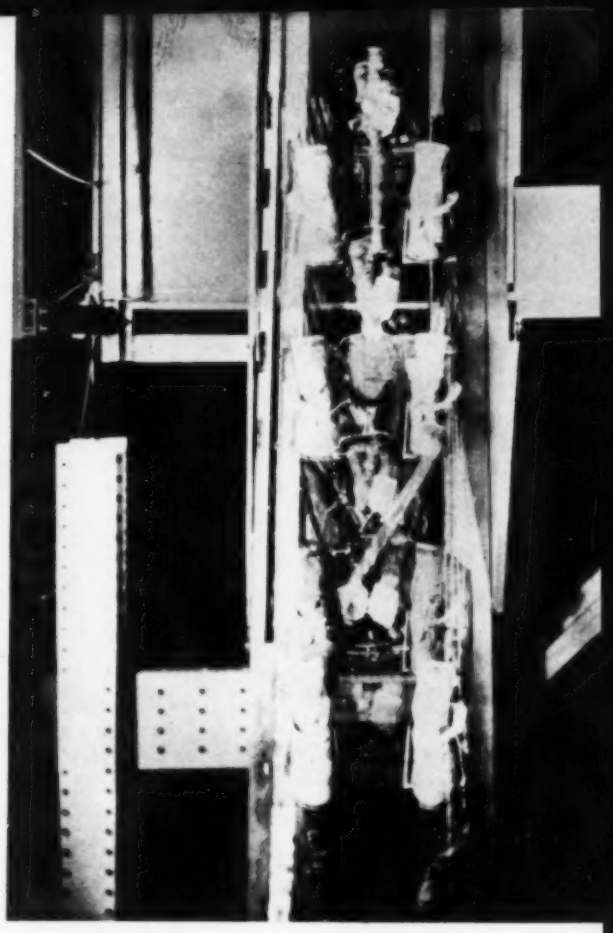
One of the most perplexing characteristics of existence in outer space is the lack of gravity, when objects remain suspended in a weightless condition. This zero-g state, as it is called, has been reproduced in the fuselage of a Dakota making what are termed "ballistic dives." The picture above shows a subject apparently floating in space in the Dakota's cabin during one of these manoeuvres.

The strangely garbed creature on the right is a St. Bernard dog which was fitted with a suit of experimental protective clothing and a special oxygen mask preparatory to undergoing tests in a cold chamber. Clothing for space-flight will have to provide protection both from the heat generated by the aircraft's rapid passage through the earth's atmosphere, and from the extreme cold of outer space.

Man in outer space must carry his own atmosphere with him, and one of the solutions to this requirement is the grotesque space-suit illustrated at left. The subject has limited freedom of movement within the pressurized garment and is provided with only one sleeve into which he can insert either arm to operate the machine's controls. This suit is primarily intended to be an insurance against cabin pressurization failure.

The monkey (right) securely trussed, anaesthetized and clothed in anti-blast suit and pressurized helmet, is ready for a test in an altitude chamber. Animal subjects are generally anaesthetized during experiments and are at other times specially cared for by U.S.A.F. doctors. It is usual for human guinea-pigs, mostly members of the laboratory staffs, to undergo the same experiments.





Much useful research work has been carried out with the family of rocket-powered aircraft produced in America. The X-1B, which is seen above mounted in the bomb-bay of its B-29 mother ship, is being topped up with liquid oxygen; the position of the 500 U.S. gal tank is shown by the collar of frost round the X-1B's fuselage. The multiple-exposure picture at right shows a U.S.A.F. officer testing a downward-ejection seat on a static rig. Keeping the arms as shown is known to cause an airflow which imposes dangerous strains on the body, and it is now recommended that the subject should keep his arms bent after grasping the firing handle, which in this case is attached to the seat-pan.

NEVER before has so much research been required to allow man to move another step forward in the furtherance of aircraft performance. Aeroplanes, as we know them, or aerodynes of forms not yet considered, will fly at speeds now termed hypersonic, and take their occupants into atmospheric conditions in which survival will be impossible without special equipment.

The environment at extreme altitudes is hostile to man's well-being; numerous factors—known, guessed at, or completely unknown—may radically affect his health and his power to think and act. America is early in the field with a research programme aimed at solving the problems, mechanical and physiological, which bar the way into outer space. Laboratories and test equipment of many kinds have been designed to help in ascertaining what these problems really are, and how best they can be solved. From such work is emerging a range of devices, from rocket aircraft to special pressurized cells, which finally will be united in a machine capable of carrying a human safely into outer space and then bringing him safely back to earth.

This research is the subject of a book by an American author, Lloyd Mallan, entitled *Man, Rockets and Space Rats* (published at $5.95 by Julian Messner, Inc., New York) in which appear, for the first time, photographs of some of the experiments carried out, and of some of the "guinea pigs," both human and animal, whose aid has been enlisted. A number of these pictures are reproduced here.

Of the two types of headgear shown below, the one on the left is the new MA-1 pressurized helmet which has been developed in America over the past five years. It is still in the prototype stage, but is designed to provide pressurization, intercomm, oxygen and, in cases of emergency, protection against wind blast and extreme temperatures. The face mask on the right has been specially fashioned to fit the monkey which is about to undergo an experiment. The animal does not appear to be unduly perturbed by his unusual equipment.

No. 18 SQUADRON

A Bomber Command Unit with a Remarkable History

PART II.

By JOHN YOXALL

ALMOST immediately, with No. 57 Sqn.—their rival squadron at Upper Heyford—they were instructed to move to France to join the R.A.F. Air Component. Squadron headquarters was established in the village of Beauvraignes. W/C. (now A.V-M.) W. A. Opie was in command.

The unit's first and obvious duty was to make familiarization flights over the local territory; but by the middle of October they received their first request for operational flying—the photographing of the Siegfried Line from Aachen to Cleve. The necessary aircraft were flown up to Metz, but before the photographic sorties could be flown the advanced landing ground was changed to Etain-Rouvres. For these photographic missions and other reconnaissances over Germany the Blenheims took off from Etain-Rouvres and landed in England, at Upper Heyford. On October 18th a move was made to Meharicourt, Picardy, where the squadron was inspected by the then Secretary of State for Air, Sir Kingsley Wood. The advanced landing ground for Meharicourt was at Seclin, near Lille.

The first casualties came on October 30th, when both F/L. Dilnot and F/O. Elliott and their crews were posted as missing. Dilnot was on a photographic reconnaissance of the Siegfried Line and Elliott on a reconnaissance over Hamm and Hanover. Casualties were, however, very rare, the circular trip up to Germany and across to England—with a landing where fancy or weather indicated—being performed with regularity. There were however, a number of forced landings and the occasional crash. The stern-frames of the Blenheims seem to have given a lot of trouble.

In December 1939 the weather was so bad that no operation flights of any importance were made, the only relief from boredom being provided by a visit to Douai for an inspection by King George VI.

The cold caused considerable trouble. Engines would not start, camera controls froze and guns would not fire. There was also frequent trouble through oxygen petering out. Almost every crew reported discomfort from extreme cold, temperatures of −30 C being quite common; sometimes readings of less than −40 C were recorded. Several of the air gunners suffered from frostbite.

The first air battle came on January 3rd, 1940, when F/O. Kempster on Blenheim L1410 took off for a reconnaissance. Shortly after becoming airborne he was attacked by one of our own Hurricanes but escaped damage. Later, Me 109s forced the Blenheim down out of control over Belgium. L.A/C. Harris was killed and Kempster and Sgt. Smith were taken prisoners.

In February began the exchange of the Blenheim Mk 1 for the long-nosed Mk 4 type. Crews flew from Meharicourt to No. 5 M.U. at Kemble, in Gloucestershire, each returning with a new aircraft. Even these flights were not without their perils; P/O. Hulton, whilst lost in fog, ran into the Downs near Tangmere and he and his observer, Sgt. Dumbreck, were killed. As delivered, the Mk 4s still needed some work to be done on them. A unit at Heston first covered all gaps, then sprayed a polishable high-speed finish, in camouflage colours, on the top half of the aircraft, with light blue on the bottom half; finally, Perspex blisters were provided to enable the pilot and observer to look astern. This was referred to in the Squadron diary as a "cleaning up" process.

In March, after six months in the field, came the first awards for the squadron's work on long-distance day and night strategical reconnaissances. S/L. K. W. Niblett (now a group captain) received the D.F.C., and Sgts. F. Miller and G. Hawkins the D.F.M.

April records were all lost during the subsequent evacuation from France, but it is well known that the German air defences became more intense as the "phoney war" came to an end: aircrews reported more fighters, more searchlights and more accurate flak.

On May 10th, 1940, when the *blitzkrieg* opened, three sorties were made to discover the extent of the German advance. From these two aircraft failed to return. The next day a further two crews and three aircraft were lost.

Scarcely a machine returned from any of the raids without damage of some sort. Sgt. A Thomas, piloting Blenheim No. L8863, was shot through the neck, the bullet passing out through the opposite jaw. Despite the pain and loss of blood from his wound he managed to fly the aircraft back to base, but he died later. On the 17th ten raids were made against German armoured

Before the blitzkrieg: a group taken while No. 18 Squadron was part of the R.A.F. Air Component in France at the beginning of the 1939-45 war. The officers are, left to right, P/O. Holmes, F/O. Elliott, F/O. Le Mesurier, P/O. Bellis, F/O. Kempster, S/L. Niblett, W/C. Opie, Capt. Weston, F/L. Dilnot, F/O. Stanley, F/O. Rogers, F/O. Langebear, P/O. Howden and F/O. Wallis.

columns; the sorties were successful, but a further two Blenheims were lost. As soon as P/O. Whelan got over the target area his Blenheim was attacked by eight Me 110s, his observer, Sgt. Mongey, being killed instantly. Subsequently the port engine was set on fire and, while trying to climb to allow the air gunner to bale out, Whelan lost control. He regained it just before hitting the ground and succeeded in making a belly landing, though he was badly burned and broke an arm. The air gunner, L.A/C. Brown, was unhurt. During the air fight Brown had noticed another Blenheim going down in flames and presumed it was F/O. Stuart and his crew, who were lost during the same action. On the same day, the squadron was ordered to move back to Guyancourt. Only two aircraft were left behind, and these were rendered unusable.

The following morning six aircraft attacked enemy armour, and all returned safely; but later the same day came instructions to move to Crécy. By mistake the Blenheims landed—with the sole aid of two petrol-tin flares—at Abbeville. Three more unserviceable aircraft were left behind at Guyancourt.

On May 19th the unit was told to proceed to England. Piloted by S/L. Rogers, F/L. Langebear, and F/O. Rees, the remaining three aircraft, one of which was really unserviceable, flew to Lympne, the ground crews following by boat *via* Boulogne. All vehicles proceeded to Cherbourg for embarkment. From Lympne the remaining Blenheims flew to Watton, Norfolk.

Within 24 hours of leaving France No. 18 Squadron was again flying operational sorties. During the morning of the 21st, P/O. Light took off for a reconnaissance of the Douai-Arras-Amiens-Abbeville area, but failed to return. Later the same day three aircraft joined up with No. 82 Squadron to bomb armoured columns on the Abbeville-Boulogne road. One of these was lost also, shot down by our own fighters.

And so the battle continued; almost every aircraft that left on a sortie was either lost entirely or returned in a badly shot-up condition with members of the crew wounded. On May 26th what remained of the squadron moved from Watton to Gatwick, and on the following day the convoy of road vehicles arrived safely from France under the command of F/O. Silk. Only one vehicle had been lost on the journey and that loss was caused by a mechanical failure.

Records for June 1940 are scanty. A move from Gatwick to West Raynham, Norfolk, was made on the 12th, but there is no record of operations being flown until July 4th, when three aircraft took off individually to attack oil targets in Northern Germany; one machine failed to return.

This was the first of many raids against such targets as shipping, harbours, canals and, of course, the concentrations of barges accummulated for the projected invasion of England. Losses suffered in this daylight bombing were very high, and instructions were eventually given to call off all raids in which good cloud cover was not available. No. 18 was now working as part of No. 2 Group. The effort was usually in the region of two or three sorties a day but occasionally this rose to as many as twelve.

In August night bombing began; but, while the casualty rate fell steeply, there was great difficulty in locating targets or assessing results. Time and again reports speak of targets not being seen owing to cloud or searchlights or A.A. By the end of September it was customary to have about 12 aircraft operating on each suitable night, but occasionally some crews did two trips, so that a total of perhaps 18 sorties resulted. The squadron was now at Great Massingham, near King's Lynn in Norfolk.

The Channel ports still formed the main targets, but by November enemy airfields were high on the priority list in order to relieve Britain from incessant night bombing. Many bombs, however, were brought back or jettisoned in the sea.

January 1941 found the squadron still at Great Massingham. A certain amount of day bombing was still in progress, but more operations were cancelled than there were carried out. Weather was the chief cause of cancellation: either it was too thick over base or too clear over the target; occasionally it was exactly the reverse; and part of the time the aerodrome itself was unserviceable.

Absence of operational flying was not for lack of effort. For instance, on February 4th eight Blenheims stood by and the C.O., W/C. Sharp took off in L9247 at 1752 hr and circled the airfield in a snowstorm to watch seven new crews safely off the ground. After one or two had taken the air, however, Sharp cancelled the projected operation. Squadron strength at this time was 18 aircrews, of which about 12 or 13 were usually available at any one time.

By March the nature of targets had changed again: now German military installations and armaments factories were being attacked. At the end of the month W/C. C. G. Hill, D.F.C., from No. 139 Squadron took over command from W/C. Sharp. His first operation was against Hanover, just before the squadron moved to Oulton, near Norwich.

From the new airfield the Blenheims were sent mostly on daylight anti-shipping patrols. Losses mounted again but the crews were at least seeing, and occasionally hitting, their targets. It is not surprising that casualties rose; the squadron diary records that sometimes these attacks against shipping were made from as low as 50ft.

Now the Station Commander at R.A.F. Upwood, where No. 18 Squadron is based, G/C. G.C.O. Key, O.B.E., D.F.C. (right) commanded the unit in 1941. With him is W/C. P. Dobson, D.S.O., D.F.C., A.F.C., Wing Commander Flying at Upwood.

After a long period of difficulty and frustration No. 18 was obviously on its toes again—the war against shipping was being pursued with zest. Operations were not always from Oulton; some were made from Chivenor, in North Devon, and it was while on the way back from one of these trips that the Blenheim flown by S/L. Lindsaye was fired on by one of our own convoys off Start Point. There was a certain amount of justification, for the convoy was actually being bombed by the Germans at the time. A few days later S/L. Lindsaye and his crew got a direct hit on a 7,000-ton enemy vessel and left it with a 35-deg list. There were plenty of targets available; on almost every sortie a ship or convoy was attacked.

Another station from which sorties were made was Portreath, Cornwall, where, on the night of May 5th, a number of the squadron's aircraft were rendered unserviceable as a result of an enemy raid. W/C. G. C. O. Key, D.F.C., was now in command. F/L. Langebear, one of the original pilots of the squadron at the outbreak of war, was lost during May.

Sgt. Burns, on Blenheim L1829, put in what must have been the lowest of low-level attacks when, on May 5th, he collided with the mast of a 1,000-ton ship. According to his subsequent report, "damage to the starboard wing and aileron control made it impossible to observe the results of the bombing." The Blenheim was coaxed safely back to base, but it collided with two other aircraft while landing.

Shipping strikes were interspersed with fighter-protected "circuses" to try to bring the Luftwaffe to action, but more day operations were cancelled than were performed.

As the shipping attacks became more and more effective the Germans reacted strongly. Convoy escorts became larger and a number of fighters were encountered. Yet still the 50-ft low-level attacks went on, despite the loss of one aircraft for every ten or so sorties.

In July came a short move to Horsham St. Faith, Norwich, but the rôle of the squadron remained the same—anti-shipping patrols interspersed by circuses and the occasional daylight raid —assisted by cloud cover—on N.W. Germany or the Channel ports. The stay at Horsham was very brief, for the middle of the next month found No. 18 at Manston, Kent. This latest move was clearly the outcome of good work over the North Sea, for enemy convoys along the French coast constituted the new targets.

On August 19th six aircraft took part in a "circus" against a power station at Gosnay, but low cloud prevented bombing of the target. On the way a call was made at St. Omer, to drop to W/C. Bader—who had been shot down shortly before—his artificial legs. After this trip every aircraft bore traces of anti-aircraft fire, and one observer had been wounded. The crew who actually dropped the legs were Sgts. Mickleson, Meadows and Pearson, flying in "F" (Blenheim 4 R3843).

By the end of August the unit was back at Horsham St. Faith, flying innumerable "beats" over the North Sea once more. But this was soon to end. On September 30th the squadron was testing "tropical" Blenheims in preparation for a detachment of the aircrews to Malta. The move started on October 10th, when 15 aircraft under W/C. Smythe left for Portreath, *en route* for Gibraltar. Each Blenheim took one passenger in addition to the crew of three. Meanwhile the remainder of the squadron were at Oulton, and later (December 10th) moved to Wattisham. While the aircraft and aircrews were away the ground crews were employed as a maintenance unit and for ground defence.

That records concerning the work of No. 18 in Malta are non-existent is not surprising when conditions at the time are considered. By March most of what was left of the squadron had been absorbed into other units in the Middle East; and at Wattisham on March 4th, 1942, No. 18 started to re-form once more with new crews from operational training units and four crews from No. 107 Squadron. W/C. Newberry was now in command.

Intensive training absorbed the squadron's whole effort until April 26th, when the first operation, against the docks at Dun-

No. 18 SQUADRON . . .

W/C. H. G. Malcolm, V.C., whose exceptional gallantry, with that of his aircrews, gave No. 18 Squadron—in the words of the A.O.C. North West Africa Tactical Air Force—"a special position of distinction in the Royal Air Force."

kirk, was made by 11 crews. On the same day several of the officers and N.C.O.s who had been operating from Malta returned to Wattisham.

The squadron duties were now in the dual rôles of bombing and intruder work by night and army co-operation by day. Aircraft were still Blenheim 4s. Each night four crews stood by for intruder work. Another change came in May, when the squadron moved up to Dundonald and later to Heathfield, Ayr, for combined operations training.

Back at Wattisham later in May, night intruding was started again. The big job of the month came on the 30th when the squadron found 17 aircrews to carry out large-scale intruder operations as diversions to the terrific 1,000-bomber raid against Cologne, which gave the enemy a foretaste of even more terrible things to come. No. 18's targets were the airfields at Juvincourt, Venlo and St. Trond. All the aircraft returned safely. On the next night, the same number of crews were briefed for a similar operation, but the raid was cancelled owing to bad weather.

Intruding was difficult and exacting work. The Germans were masters of the art of camouflage and decoy, but on a very high proportion of sorties No. 18's pilots were able to distinguish between the dummies and the actual airfields in use. For instance, on the night of June 1st all 17 aircraft found and bombed their primary targets in support of a second attack on Cologne. The Blenheims' standard loads on these trips were made up of 2×250 lb, 8×40 lb and 24×9 lb bombs, the two last-named sizes being incendiaries. That the attacks were effective is borne out by the reports of increased opposition at the airfields visited nightly.

The last operations from England were flown on the night of August 17, 1942, after which the squadron went on embarkation leave in preparation for moving abroad. A move was made to West Raynham, and aircrews flew down to Filton to bring back Bristol Bisleys (Blenheim 5s) in exchange for their Blenheim 4s.

On November 1st the ground personnel left in the liner *Arundel Castle* from Glasgow and ten days later 18 Bisleys were detailed to fly from Portreath to Blida, North Africa. Of these 17 set course at 0130 hr and ten arrived at Blida without mishap at 0930 hr. The remainder had various adventures. One was delayed with mechanical trouble but set course three hours later and arrived safely at Blida at 1130 hr. Another had wireless faults, and a third returned to Portreath because of a petrol leak. A fourth crash-landed shortly after take-off, and No. 5 ran out of fuel and crash-landed ten miles from Blida. The sixth lost its way and landed at Noisey, near Oran. Of the seventh, nothing was heard after take-off.

Despite difficulties during the outward journey, the squadron was in operation within 17 hours of arrival at Blida. Six Bisleys were detailed to attack El Aouina airfield.

This was the period shortly after "Torch," the invasion of North-West Africa, when the Allied front was too far away from our airfields to be given continuous fighter cover. It, therefore, devolved on the light bombers to attack the Luftwaffe on its airfields. Attacks were made by both daylight and night.

An airfield which appeared frequently on the target list was Bizerta/Sidi Ahmed, and the report of a day raid on November 17th, 1942, gives a good impression of conditions obtaining at the time. Twelve Bisleys were detailed and the raid was pressed home in formation at heights varying from 15ft to 150ft, the approach to the target having been made at sea level. Despite flak and fighter resistance eight Bisleys attacked successfully, bombs being seen to burst on hangars and sheds. Hundreds of rounds were fired at parked aircraft. Two Bisleys were seen to collide while approaching the target and crashed at Cap Serrat, and a further two were shot down by Messerschmitt Me 109Fs. It was believed that the Bisleys shot down two Me 109s. One Bisley, flown by S/L. Tucker, was hit by light A.A. during the run-in to the target and had its rudder shot away. It continued to the target and bombed but was eventually made to force-land at Djidelli after being chased by German fighters.

On the last day of November the squadron moved up to Canrobert for close-support work. W/C. Malcolm was in command. They operated from the Souk-el-Arao forward landing ground and were engaged in the Chouigui area, where the First Army were holding on desperately.

Casualties were very high, largely owing to the absence of fighter cover. On December 4th the squadron was virtually wiped out. After two attacks in the morning against an enemy landing ground ten miles north of Chouigui, W/C. Malcolm led a further formation of ten Bisleys against the same target at 1515 hr, with no fighter escort. A report written at the time says that, on arrival over the target at 1,000ft, they were attacked by between 50 and 60 fighters. It goes on: "Only three crews survived the attacks of the fighters. Of these, three officers and one N.C.O. were injured and each of the three aircraft was shot down and destroyed; they came down in our own lines and the crews were saved. A fourth plane was also shot down in our own lines, all the crew being killed, while the remaining five are missing. Several fighters were definitely destroyed by the Bisleys and a number damaged."

As a result of this action W/C. Malcolm was awarded the Victoria Cross. The citation reads:

"This officer commanded a squadron of light bombers in North Africa. Throughout his service in that theatre his leadership, skill and daring were of the highest order.

"On November 17th, 1942, he was detailed to carry out a low-level formation attack on Bizerta airfield, taking advantage of cloud cover. Twenty miles from the target the sky became clear, but W/C. Malcolm carried on, knowing well the danger of proceeding without a fighter escort. Despite fierce opposition all bombs were dropped within the airfield perimeter. A Junkers 52 and a Messerschmitt Me109 were shot down; many dispersed enemy aircraft were raked by machine-gun fire. Weather conditions became extremely unfavourable and, as a result, two of his aircraft were lost by collision; another was forced down by enemy fighters. It was due to this officer's skilful and resolute leadership that the remaining aircraft returned safely to base.

"On November 28th, 1942, he again led his squadron against Bizerta airfield, which was bombed from a low altitude. The airfield on this occasion was heavily defended and intense and accurate anti-aircraft fire was met. Nevertheless, after his squadron had released their bombs W/C. Malcolm led them back again and again to attack the airfield with machine-gun fire.

"These were typical of every sortie undertaken by this gallant officer; each attack was pressed to an effective conclusion, however difficult the task and however formidable the opposition.

"Finally, on December 4th, 1942, W/C. Malcolm, having been detailed to give close support to the First Army, received an urgent request to attack an enemy fighter airfield near Chouigui. W/C. Malcolm knew that to attack such an objective without a fighter escort—which could not be arranged in the time available—would be to court almost certain disaster; but, believing the attack to be necessary for the success of the Army's operations, his duty was clear. He decided to attack. He took off with his squadron and reached the target unmolested, but when he had successfully attacked it his squadron was intercepted by an overwhelming force of enemy fighters. W/C. Malcolm fought back, controlling his hard-pressed squadron and attempting to maintain formation. One by one his aircraft were shot down until only his own aircraft remained. In the end he, too, was shot down in flames.

"W/C. Malcolm's last exploit was the finest example of the valour and unswerving devotion to duty which he constantly displayed."

At the time of his death he had commanded the squadron for nearly three months. The Malcolm Clubs are named after him.

To replace W/C. Malcolm as commanding officer, S/L. Tucker was promoted to the acting rank of wing commander. The remaining operational aircrews were sent back to Setif to rest.

The squadron was, however, out of action for only ten days; and December 27th found them back at Canrobert on night interdiction, the use of Bisleys (Blenheim 5s) for daylight operations having been more or less discontinued. By January 1st the strength of No. 18 was 14 aircrews and six aircraft—one of which was a Blenheim 4. Very effective work was put in on moonlit nights, mostly against transport on the roads leading to Sfax and Tunis. Casualties were low, but the squadron was unlucky enough to lose its second commanding officer within six weeks: after a take-off at 1818 hr on the evening of January 18th, nothing further was heard of W/C. Tucker or his crew, F/L. Docherty and F/Sgt. Bartley.

An extract from the squadron diary gives an excellent impression of the effectiveness of the squadron's work; this is but a portion of one report out of very many:

"Bisley Q (F/L. Eller, P/O. Browne and Sgt. Coughlan) off 1945, landed 2225 hr, patrolled from 2040 to 2115 and in the shadows of the trees along the road N.E. of Mornaghia saw a stationary convoy of 30 to 50 vehicles. Four 250 lb bombs and four 40 lb bombs were dropped from 1,000ft and direct hits were observed on the transports, a cloud of smoke rising. The aircraft then went down to 50-100ft and swept the convoy with machine-gun fire. Three miles W. of Sebkret-es-Sedjoumi a nest of six or seven light guns opened up and were fairly accurate up to 1,200ft; one of the guns ceased firing when attacked with 200 rounds from 1,000-500ft."

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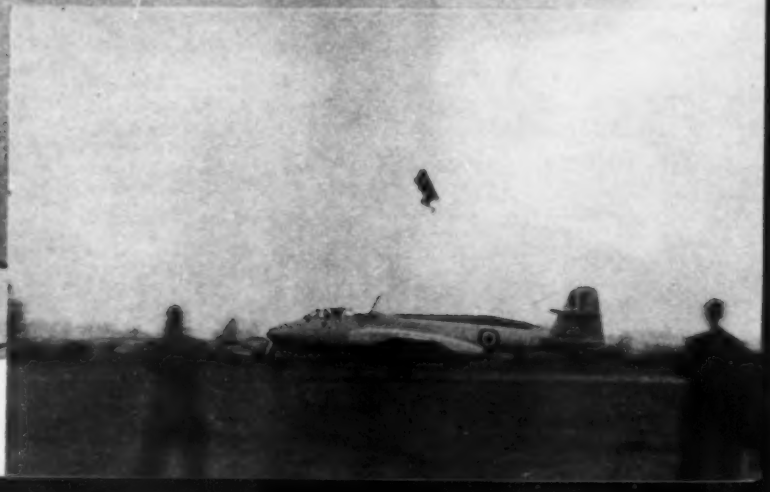


No. 18 SQUADRON . . .

This was part of one sortie out of eleven flown by the squadron that night. They were all able to find targets in plenty.

At the end of January 1943 all the Bisleys and their equipment were handed over to No. 614 Squadron, R.Aux.A.F., and the crews were sent on rest pending re-equipment.

February began with some news of crews who had been missing since the ill-fated attack on December 4th. W/C. Malcolm's aircraft was found 15 miles west of the target, and F/Sgts. Williams, McCombie and Brown were known to be prisoners of war. News came too, of the aircraft lost on the journey from Portreath to Blida; it had landed in Spain, and the crew—P/O. Willis and Sgts. Rounding and Murphy—had succeeded in returning to England.

Pilots kept their hand in with a few Bisleys "borrowed back" from No. 614; but re-equipment—with Douglas Bostons—soon began, and intensive training on the new type commenced.

A quiet familiarization period was rudely interrupted by Rommel's Panzer divisions making a determined thrust for Gafsa. By borrowing some more Bisleys No. 18 temporarily became operational again for night attacks. In a short time, back to a strength of 12 Bisleys and keeping up 100 per cent serviceability, the squadron was again making all the familiar night attacks against H.Q. buildings and transport targets on the roads.

S/L. Sandeman, one of the flight commanders, was promoted to the rank of wing commander and took over command. Two pilots, F/O. Holloway and P/O. Eckersley, were attached to No. 114 Sqn. in order to return to England to ferry out more Bostons; No. 18's first aircraft of this type had been borrowed locally from the Americans.

At this juncture the squadron was taken over by the new Tactical Bomber Force and, with the other Bisley squadrons, Nos. 13 and 614, moved to Oulmene. Although there were few serious casualties at this period, the Bisleys were occasionally caught out. For instance, on the night of March 15th, 1943, S/L. McCurdy, with F/O. James and F/Sgt. Edwards as crew, was attacking the landing ground on the north side of Djebel Tebaga, near Gabes, when four or five guns opened up with very accurate fire. The aircraft was hit and Edwards wounded in the left elbow and thigh. McCurdy circled while James leaned through the well to help Edwards to bind up his wounds. This accomplished, another attack was made, in which more damage was sustained by the Bisley.

Another Bisley, flown by P/O. Wilson in the same attack, ran into an electrical storm while over the target area and later into two more, which rendered the wireless useless. After 5½ hours' flying—with one hour's petrol left—the crew had been unable to locate the airfield by dead reckoning. With 30 minutes' fuel to go, the order was given to jettison the hatches. Then, on seeing lights below, Wilson displayed his navigation and downward identification lights, and the Bisley was directed by searchlights to Bone airfield, where a successful landing was made—with only seven gallons of fuel left in the tanks. The runway was 700 yards long and had swamps on both sides and at one end!

An interesting note in the squadron diary refers to the detailing of three Bisleys on the night of March 23rd to act as a pathfinder force for a subsequent attack by Wellingtons against Djebel Tebaga airfield. The pathfinders each carried 2 × 250 lb H.E., 4 × 40 lb H.E. and 360 × 4 lb incendiaries. The Bisleys also shot up the airfield.

At the end of the month the squadron again became temporarily non-operational. By this time six Bostons were on charge. S/L. A. W. Eller—who had for a short while commanded the squadron, and had been with it for over a year, completing 33 successful operations—left for duty in the operations room of H.Q. Tactical Bomber Force. All the Bisleys were transferred to R.S.U.; and No. 18, with its new Bostons, moved up to "Kings Cross" near Souk-el-Khemis—and were promptly bombed on arrival, luckily without serious damage.

The first Boston operation was flown on April 21st, 1943, when a "box of six" was briefed to attack, with fighter escort, enemy troops on a hillside near Medjez-el-Bab. Rodded 250 lb and 40 lb bombs were used. All the aircraft returned safely.

The "box of six" technique became the standard manner of attack. Usually there were Spitfires to give protection, but during an attack by five Me109s on April 25th Sgt. Baker, flying "D," was hit in the starboard engine. He could no longer keep pace with the formation so broke away and aimed his bombs at the primary target, which he hit. On course for home the starboard engine caught fire and, as the fire increased, Baker made a belly landing in a cornfield in no-man's land. After crawling on their hands and knees for a quarter mile the crew came to barbed-wire entanglements, which they surmounted, and then negotiated a mine-filled wadi, finally falling in with a British patrol who passed them on to Brigade H.Q.

After being dined and wined they were driven back to base in a captured German car. It was not their day out, however, for on the way the car left the road and rolled 20 or 30 yards down an embankment; but it finally landed on its wheels, and nobody was seriously hurt. While a wagon was pulling the car back on to the road the enemy dropped a stick of bombs 50 yards away. The crew eventually got back to base 15 hours 20 minutes after setting out, to find they had been the only crew to bomb the target; the remainder of the formation had been chivvied off by the 109s.

On April 23rd came the news of the posthumous award of the Victoria Cross to W/C. Malcolm. The following message was received from the late Air Marshal Sir Arthur Coningham, then commanding the North-west Africa Tactical Air Force:

"Please accept my personal congratulations on the signal honour bestowed on your squadron by the King's award of the Victoria Cross to your late commanding officer. The gallantry of W/C. Malcolm and his aircrews have by this award given No. 18 Squadron a special position of distinction in the Royal Air Force. You deserve your pre-eminence and I wish all officers and airmen of the squadron to know how proud we are of them."

Two days later came more congratulations, this time for the awards of immediate D.F.C.s to S/L. Eller, F/L. Rothwell and F/O. Holloway.

On May 3rd the squadron was stood down for two days and all the aircrews, together with as many ground crew members as could be spared, had a brief but welcome interlude by the seaside at Tabarka.

The holiday over, a state of readiness was resumed from 0900 on May 5th and in the afternoon 12 Bostons in formation set out to attack the enemy at Djebel-bou-Aoukaz in close support of the First Army's final push to capture Tunis. By the 11th all was over, with only mopping up operations to be done by the Army. The squadron was stood down for the want of targets.

An analysis of the unit's work in North Africa on two types of aircraft shows these figures:

Bisley.—Sorties, 245; successful, 189; abortive, 15. Missing, 11. Time flown, 798 hr 44 min. Bombs dropped, 245,580 lb.

Boston.—Sorties, 233; successful, 223; abortive, 10. Missing, nil. Time flown, 242 hr 32 min. Bombs dropped, 302,950 lb.

At this stage six crews were posted to No. 614 Sqn. and 11 crews from 614 to No. 18. This left the unit with only three of the original flying personnel who had started the North African campaign with the squadron seven months earlier. They were F/Sgt. R. H. Honeker and Sgts. J. J. Johnson and R. A. Coughlan.

A move was now made to Grombalia, where No. 18 Sqn. was visited by Mr. (now Sir) Winston Churchill, Mr. (now Sir) Anthony Eden and a number of high-ranking officers. The Prime Minister spoke to a large gathering of the R.A.F. and U.S.A.A.F. At a later date Lord Trenchard visited Grombalia and in his address singled out No. 18 for special praise.

By the middle of June operations were being flown once more, this time against the island of Pantellaria, which was on the flank of the projected attack against Sicily. One Boston was missing from the first attack and a number of others damaged after being jumped by four Me109s. The island was occupied by June 11th and the attack switchd to Lampedusa, another island, which fell the next day.

Again the squadron was without targets, but night flying training fully occupied both air and ground crews. On June 19th, 1943, King George VI, accompanied by Sir Arthur (now Lord) Tedder visited Grombalia and inspected the squadron.

The non-operational period lasted for only a short time. On July 3rd the squadron was ordered to stand by for night operations and that night eight Bostons took off to bomb Comiso airfield in Sicily. One was lost. This operation was typical of the attacks against the Sicilian airfields prior to the landing by the Army.

As a prelude to the actual invasion, maximum effort was ordered and nine Bostons, out of a total of ten, were detailed to operate. In addition to dropping rodded bombs over the airfields in the Catania area, the attackers caused diversions by dropping 72 dummy parachutists and firing 20 Very cartridges fired at specified points.

On July 27th the advanced echelon of the squadron moved to Sicily, crossing the Mediterranean in the landing ship L.S.T.4 from La Gaulette to Gela. Meanwhile the Bostons operated from Malta.

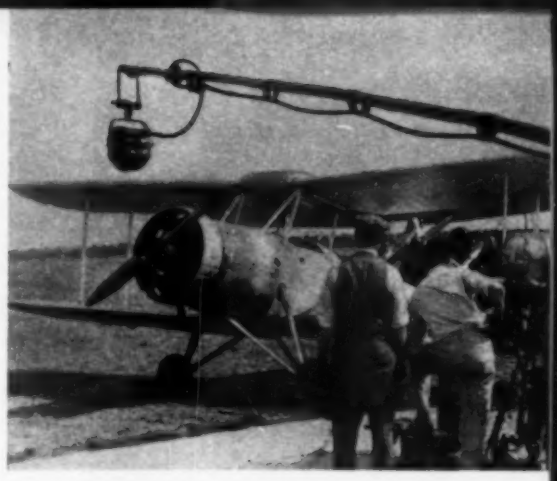
(To be continued)

Commanding Officers of No. 18 Squadron

	from
Maj. G.I. Carmichael, D.S.O.	11/5/15
Maj. R.S. Maxwell, M.C. ...	19/12/16
Maj. G.R.M. Reid, M.C. ...	30/3/17
Maj. G.R. Howard, D.S.O. ...	24/11/17
Maj. J.B. Elliott	1/11/18
Maj. J.F. Gordon, D.F.C. ...	5/11/18
to December 1919	
S/L. I.C. Luke	20/10/31
S/L. G.S. Shaw	21/1/35
S/L. C.R. Steele	16/1/36
S/L. E.G.C. Stokes	12/4/37
S/L. H.E. Forrow	11/10/37
S/L. K.W. Niblett	30/5/38
W/C. W.A. Opie	6/5/39
W/C. G. Bartholomew ...	-/5/40
W/C. A.C.H. Sharp	14/10/40
W/C. C.G. Hill, D.F.C. ...	17/3/41
W/C. G.C.O. Kay	23/4/41
W/C. D.C. Smythe, G.M. ...	7/7/41
W/C. J.R. Cree, D.F.C. ...	1/3/42
W/C. J.H. Newberry ...	13/4/42
W/C. H.G. Malcolm, V.C. ...	24/7/42
W/C. W.J.M. Tucker ...	5/12/42
W/C. D.C. Sandeman, D.F.C.	22/2/43
Lt. Col. L.L. Gordon, D.F.C. (S.A.A.F.)	5/12/43
W/C. A.K. Passmore, D.F.C. and Bar	3/1/44
W/C. V. Rees	22/1/45
to March 1946	
W/C. B.E. Peck	1/9/46
to September 15, 1946	
S/L. R.M. Burns	8/12/47
S/L. J.D. Kirwan, D.F.C. ...	18/5/48
to February 1950	
S/L. R.A. Cooper, M.B.E. ...	1/8/53
S/L. A.H. Chamberlain ...	22/11/54

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.



The photograph of G-ACHP referred to in the letter below from Sir Archibald Hope, joint managing director of Airwork, Ltd.

I.C.A.O. Oddities

IS I.C.A.O. international? Yes, I suppose it is, if viewed as an assembled body of contracting states.

But, as a rider to the question, how far do the party States back up the principle for which I.C.A.O. stands? For the convention is not a law unto itself, has no tribunal or penalizing authority. It does, however, succeed in unifying a large amount of aviation practice, and, though it continues to win a measure of agreement, one is surprised to find such extraordinary anomalies as still exist.

For example, a Belgian Commercial Pilot's Licence may not be exchanged for the French equivalent; the M.T.C.A. in this country will accept neither, and in many other countries there is no reciprocal arrangement for crew licensing either.

Yet, in spite of this, under the pool agreement of I.A.T.A., B.E.A. is busy selling thousands of seats a year for Sabena, Sabena for Swissair, no doubt Swissair for Air France, and so on around the circuit.

And, though it has nothing to do with it, for what possible good reason may one not buy a glass of whisky whilst overflying Germany?

Radlett, Herts. R. H. H. SLADE.

Jettisonable Rocket Motors

HAVING read the letter [January 27th] from Mr. W. L. Gore of Aerojet-General Corporation on the first jettisonable liquid-propellant motor, I must differ from his line of thinking by pointing out the existence in Germany, in late 1942, of the B.M.W. 718 bi-fuel motor, which was jettisonable and rated at the high thrust of 2,700 lb for three minutes. The B.M.W. 718 motor was fitted to a number of aircraft, one of the most notable being the Me262. Though the B.M.W. 718 was superseded by the Walter H.W.K. 509A, for reasons of reliability, it must surely rate as the world's first jettisonable liquid-propellant motor.

Bristol, 5. DAVID LILLIMAN.

[We do not think that Mr. Gore was claiming that the Aerojet motor was the first to go into service, but only that it was considerably earlier than the Super Sprite. The B.M.W. 718 was one of several German units of this type in the early war period.—Ed.]

Gap in the Map

PROTAGONISTS who have been agitating for improved internal air services within the British Isles will have read with satisfaction the news that provisional approval has been given to B.K.S. to operate a regular air service between London Airport and Leeds (Yeadon). This new service will permit good air connections between all major northern industrial or tourist centres and London.

A glance at an air-route map, however, will show little cause for complacency as yet. Several large and important towns are still not connected to London by air. Of these, Norwich cannot at present be served as it does not possess an airfield. On the other hand, Cardiff, Swansea and Exeter have airfields from which local services radiate to the near Continent but *not* to London.

Exeter, at least, surely merits an air connection to L.A.P. The enormous tourist potential available in the West Country would appear to justify an experiment by one of our leading independent operators.

It may be argued that such services are uneconomic, but to the best of my knowledge the services to Liverpool (Starways), Newcastle (Hunting Clan, with Heron aircraft) and Bembridge, I.O.W. (summer only) have not only achieved high load-factors, but have been run at a profit to the operators concerned.

Let us hope, therefore, that by next summer we may be able to board a plane at L.A.P. for a flying visit to glorious Devon.

Chessington, Surrey. BRIAN J. MITCHELL.

The Late Lamented Cadet

THE letter from Mr. David Ogilvy regarding Avro Cadet G-ACHP aroused much interest among the many employees who remembered it and who worked on it at Heston.

You may be interested in the enclosed photograph of the aircraft taken whilst it still had a radial engine. This shows that it was used for the Warner Brothers production of the film *The Blue Army* (later generally released under the title of *The Blue Squadron*).

It would be superfluous for me to list all the distinguished pupils who flew this aircraft, but you may also be interested to know that this was the aircraft on which the late Lord Londonderry did most of his training for his air licence at the time that he was Secretary of State for Air.

London, W.1. ARCHIBALD P. HOPE.

Ultra-light Duration Record

HAving just been through your excellent magazine of January 6th, I find something not quite true to fact on page 6, in "Here and There." You mention, in the paragraph concerning Al Mooney, that his Mite still holds the under-500 kg world class record for unrefuelled flight with 1,300 miles.

I am sure this is an oversight on your part, as the record is now held by ourselves since August 4th, 1955, with one of our Tipsy-Belfair aircraft flown by P.I.R. Andersen, for a distance of 1,637 miles, from Chièvres in Belgium to Sidi-Ifni in Ifni, a Spanish outpost on the West African coast.

Gosselies, Belgium. MAURICE TIPS,
Manager, Technical Department, Avions Fairey S.A.

[This is, of course, correct; confirmation of the new record was announced by the F.A.I. last November.—Ed.]

FORTHCOMING EVENTS

Feb. 10. Helicopter Association: "Engineering Aspects of Helicopter Bus Operations in City Centres." Three papers introduced by J. S. Shapiro, Dip.Ing., A.F.R.Ae.S. (at 5.30 p.m.).

Feb. 11. British Interplanetary Society: Birmingham Branch: "Aerodynamic Considerations of an Orbital Rocket," by W. F. Hilton, Ph.D.

Feb. 14. R.Ae.S.: Graduates and Students Section: "Flight-Testing of High-Speed Aircraft," by T. H. Kerr.

Feb. 16. R.Ae.S.: Main Lecture at Yeovil: The First Henson and Stringfellow Memorial Lecture, by Dr. A. M. Ballantyne, T.D., B.Sc., A.F.I.A.S., Hon. F.C.A.I., A.F.R.Ae.S., and Capt. J. L. Pritchard, C.B.E., Hon. F.I.Ae.S., Hon. F.R.Ae.S., M.R.I.

Feb. 17. Air Transport Auxiliary Association: Annual Dinner, Eccleston Hotel.

Feb. 17. Association of British Aero Clubs and Centres: Annual Dinner.

Feb. 21. R.Ae.S.: Section Lecture: "Design of Low Landing Speed Aircraft," by R. C. McIntyre, A.F.R.Ae.S.

Feb. 23. Aerodrome Owners Association: Annual General Meeting, and Annual Dinner.

Feb. 24. Lancashire Aero Club: Annual Supper Dance.

Feb. 28. R.Ae.S.: Section Lecture: "Use of Elementary Plasticity in Design," by A. J. Barratt, B.Sc.(Eng.), M.S. in A.E., M.I.A.S., A.F.R.Ae.S.

March 1. R.Ae.S.: Section Lecture: "Powerplants for Supersonic Flight," by Dr. E. S. Moult, B.Sc., M.I.Mech.E., F.R.Ae.S.

R.Ae.S. Branch Fixtures (to February 24th)

Feb. 10, *Brough*, Annual Dinner Dance. Feb. 13, *Halton*, Film; *Henlow*, Annual General Meeting.

Feb. 14, *Bristol*, "Aerial Photography," by Charles E. Brown. Feb. 15, *Coventry*, Lecture by E. P. Hawthorn; *Reading and District*, Lecture and Film Show on Guided Weapons by S/L. R. E. W. Harland. Feb. 16, *Isle of Wight*, "Operation of Turbo-Propeller Aircraft," by P. G. Masefield; *Yeovil*, Main Lecture (see above). Feb. 21, *Belfast*, "The New London Airport," by R. F. Bulstrode. Feb. 22, *Weybridge*, "Training and Research in the Field of Aircraft Production," by Prof. J. V. Connolly. Feb. 23, *Cheltenham*, "The Investigation of Flutter by Flight Tests," by H. G. Pencock. Feb. 24, *Leicester*, Lecture.

Typical of C.A.S.A.'s present transport designs is the C.A.S.A. 202 Halcón, twenty of which are at present being built in the company's main factory at Getafe, near Madrid.

MADE IN SPAIN

Part 2—The Work of C.A.S.A.

By C. M. LAMBERT

HOLDING pride of place as the oldest and largest aircraft construction company in Spain, C.A.S.A. (Construcciones Aeronáuticas, S.A.) has, since its foundation in 1923, built a wide variety of aircraft, both of its own design and under licence from abroad. During 1923 the first factory, with a floor area of 21,520 sq ft, was built at Getafe, about 12 miles south of Madrid on the road to Toledo, and close to the small sugar-loaf hill which is said to mark the exact centre of Spain. In the succeeding years three other factories were set up, one in Cadiz, one in Madrid itself and one at Seville. The main offices are at Rey Francisco, 4, Madrid. In 1954 the floor areas of the factories were: Getafe, 430,560 sq ft; Seville, 290,630 sq ft; Cadiz, 118,400 sq ft; and Madrid, 129,170 sq ft. An extension programme, particularly at Getafe, has since led to a sizeable increase in floor area.

Mainly concerned with engineering work, the factory in Madrid itself produces the more complex parts for the other three factories. The Cadiz works, being on the coast, has traditionally been connected with the construction of flying-boats and seaplanes but is at present completing an order for Bücker Jungmanns—the well-known biplane trainers of pre-war German design. A large number of these, and of the Jungmeister single-seater, have been delivered to the Spanish Air Force. Some small sub-assemblies of the C.A.S.A. 2.111 such as rudders, are also produced at Cadiz. At one time or another C.A.S.A. has produced under foreign licence the Bréguet 19, the Vickers Vildebeest, the Dornier Wal, the Junkers Ju52, the Heinkel He111, and Bücker Jungmeisters and Jungmanns.

I visited the factories in Seville and Getafe and, at the first-named, was most hospitably received by Don José María Cervera y Cervera, the works director. The factory was built in 1940 and a contract was then placed for 200 Heinkel He111s to be produced under German licence and powered by Junkers Jumo 211-F engines of 1,340 h.p. The aircraft were given the Spanish designation C.A.S.A. 2.111. Four versions have been built, a day bomber, a reconnaissance bomber, a trainer and a command transport; and a maritime patrol conversion is at present being studied. Major components for all the 200 aircraft are now complete and 130 of them were delivered to the Spanish Air Force some time ago. But the source of German engines dried up in about 1953 and at about that time one C.A.S.A. 2.111 was converted to take Rolls-Royce Merlins. The modification was difficult but was successfully completed, and the Merlin has been adopted as the standard powerplant for this aircraft. Airframes which had been awaiting engines are now being taken out of store in Seville, modified and completed with Merlins. The C.A.S.A. factory is also carrying out major repair and overhaul of the Jumo-powered aircraft already delivered to the Service and these will, at a later date, be converted to take Merlins.

In addition, the Seville factory is making the outer wings of the C.A.S.A. 201 Alcotán and the C.A.S.A. 202 Halcón for the Getafe factory, and also doing some stamping work for a motor-cycle concern. The factory is the most modern of the four C.A.S.A. units and the main building is one long hall, into which prepared materials are brought in at one end, complete aircraft leaving through the 200ft-wide doors at the other. After engine runs in a yard outside they are towed along a short track to Tablada airfield for flight tests.

Everything for the C.A.S.A. 2.111 except radio, instruments, tyres and a few other parts are produced in the factory itself. Undercarriages, hydraulic equipment, brakes and even rivets and nuts and bolts are made and tested on the spot.

It was most interesting to see these German aircraft still in full production; and later, when I was able to fly a Jumo-powered C.A.S.A. 2.111 trainer myself, I was much impressed with its excellent handling qualities. It is worthwhile recording some of the features of the aircraft. Its span and length are 74ft and 54ft. It has a wing area of 930 sq ft and a maximum wing loading of 33 lb/sq ft. Empty and maximum weights are 18,500 lb and 31,000 lb and the bomb load is 4,430 lb; a crew of five is carried. The maximum speed is 272 m.p.h., cruising speed 224 m.p.h. and service ceiling 22,000ft.

In the bomber version the pilot sits on the port side and has his engine and utilities controls on a series of sloping consoles to his left. The control column is in the middle of the floor and the spectacle wheel is carried over to the left on a swinging arm so that its height can be adjusted to suit the pilot; or the whole wheel can be swung over to the starboard side for the use of a co-pilot.

The bomb-aimer/front gunner has a couch on the starboard side of the nose and a 12.7 mm Breda machine-gun mounted in the fuselage nose-cap, which is offset to starboard. The forward part of the bed of the couch can be slid back to expose the bomb-sight and aiming window beneath it. Bombs are stowed upright in eight containers just behind the pilot's compartment and each container can be emptied through its own pair of doors. Ventral and mid-upper gun blisters carry 8 mm machine-guns. Radio operator and gunners use a number of folding seats distributed around the after fuselage behind the bomb chamber. In the reconnaissance/bomber version the four starboard bomb chambers are replaced by a single universal vertical camera mount whose hatch is covered by sliding metal panels. The machine is otherwise identical with the bomber.

The third variant is the pilot trainer. In this case all eight

The Heinkel He111, built under licence at Seville as the C.A.S.A. 2.111, is still coming off the production lines. The Junkers Jumo 211-F engines are now being replaced by Rolls-Royce Merlins, two of which are seen here in an aircraft awaiting flight tests outside the factory. The airscrew spinners have not yet been attached.

MADE IN SPAIN . . .

The airframes of the 112 C.A.S.A. 201 Alcotáns ordered by the Spanish government are now complete, and four of them, shown here, have flown powered by Armstrong-Siddeley Cheetah 27s. Three others have been built with Alvis Leonides, P. and W. Wasp Junior and E.N.M.A.S.A. Sirio S-VII engines.

bomb-chambers are replaced by two short bench seats, and the bomb-aiming and gunnery installation in the nose is deleted. Side-by-side dual controls are provided with two separate control columns and a central throttle pedestal. The control wheels are rather small and the additional cable-runs involved have made the trainer, in comparison with the bomber, a little heavier to handle.

Finally, there is the command transport version, in which the two gun-blisters and bomb-bay have been eliminated, an access door cut in the starboard side of the rear of the cabin and a very comfortable nine-passenger layout and toilet installed. There are four crew positions, including dual controls for two pilots. Only 15 of these transports have been ordered, for the Air Force.

The majority of C.A.S.A. 2.111s have glider-towing attachments in the tail, though these are a relic of a much earlier requirement which has since been superseded. A refinement being tried by C.A.S.A. is the fitting of a Sperry A.L.3 autopilot, and it is possible that all the 2.111s will eventually be so fitted.

The lines of the aircraft bear witness to the Heinkel company's keenness on streamlining, and this fact makes the airframe a fairly complicated one to build. The wing centre-section, for example, is continuous through the fuselage, and includes engine nacelles, undercarriage mountings, the inner fuel-tank bays and bomb doors; altogether, it is a complicated structure with many changes in dihedral and plan form. C.A.S.A. are quite proud of the work they have done in building these machines and feel ready to cope with any complex structural problems of a similar kind which may come their way.

By contrast with the C.A.S.A. 2.111, the wings of the Alcotán and the Halcón are very simply conceived. Except for the main spar booms (which are extruded and machined at Bilbao) and the wing-root fittings, it is built up in straightforward sheet-metal units which are easily assembled in a simple jig. Flaps and ailerons are both slotted and their hinge-lines are continuous along the whole semi-span.

I saw Alcotáns and Halcóns being built in the factory at Getafe, where I was shown round by Don José María Román, the factory director. A good deal of extension work is going on in order to accommodate the production of the new, larger aircraft and to house the I.R.A.N. work on Sabres, which is now beginning under U.S.A.F. contract.

A very large new hangar is being built with a floor measuring 263ft × 342ft, obstructed only by a single pillar in the centre. The main doorway is 342ft wide and additional side doors are each 131ft wide. Between the new hangar and the present factory an apron 330ft wide is being prepared, and this and further hard-standings are to be completed in the spring.

C.A.S.A. cockpit design, as shown by this view of the Halcón's flight deck, is neat and conventional. Autopilot controls are prominent in the centre of the panel.

It is here that all the Alcotáns and Halcóns are being built; in fact, all the 112 Alcotán airframes ordered are now complete. Four of them have been fitted with Armstrong Siddeley Cheetah 27s of 475 h.p., one with Pratt and Whitney Wasp Junior (450 h.p.), one with Alvis Leonides (550 h.p.) and one with the new E.N.M.A.S.A. Sirio S-VII (500 h.p.). The Sirio is still undergoing type-testing, but it is understood that it will be the standard engine for these aircraft.

The Alcotán is classed as an 8/10-passenger transport with a range of 436 to 622 miles. The empty weight of the Sirio-engined version is 80 lb more than that of the Cheetah-powered machine, but its all-up-weight at 12,150 lb is 555 lb greater. The cruising speed with Sirios is 193 m.p.h. The volume of the passenger cabin is 494.4 cu ft and the minimum head-room 5.4ft. Based on a utilization of 1,000 hours per year, a cruising speed of 193 m.p.h., an all-up-weight of 12,150 lb and a cruising altitude of 6,590ft, an operating cost of 1.9 pence per passenger mile is quoted for a stage-length of 312 miles.

The Alcotáns have been built mainly for the Spanish Air Force and some of them are fitted out as navigation trainers, in which case the type is identified by a series of astrodomes distributed along the cabin roof. Others are bombing trainers and have bomb-aiming equipment and internal accommodation for two 250 kg bombs. Yet another version is the ambulance aircraft carrying four stretchers and four seated patients.

A more recent C.A.S.A. transport design is the C.A.S.A. 202 Halcón, a 14-passenger aircraft powered by two E.N.M.A.S.A. Elizalde B.1A engines giving 775 h.p. at take-off. This is a rather larger machine than the Alcotán and has a span of 71ft, a length of 52ft 7in and a height of 19ft 8in. The nosewheel undercarriage is designed and made by the company, but structural details are generally very similar to those of the Alcotán. The Halcón has been designed in accordance with the British airworthiness requirements. A pre-series of 20 has been ordered by the Spanish government and of these some 13 have been completed. The first prototype is at present in the factory being fitted with two Wright Cyclone 9s of 1,200 h.p. which have been taken from an American Lodestar. T.K.S. porous-strip de-icing is also being installed. The Beta-powered Halcón has imported Rotol airscrews and the Cyclone-powered prototype will have Hamilton Standard units.

The Halcón's empty and maximum weights are 11,300 lb and 17,100 lb. The wing area is 617.8 sq ft and the wing loading 27.5 lb/sq ft. Maximum and cruising speeds at 9,350ft are 215 m.p.h. and 202 m.p.h. Minimum speed with flaps is 75 m.p.h. and take-off and landing runs are respectively 2,140ft and 2,560ft. The service ceiling is 24,200ft and the range 750 miles.

More recently C.A.S.A. has produced two design projects for transports powered by two Bristol Hercules engines. One of them, the C.A.S.A. 208, was to have been a twin-boom high-wing transport very similar to the French Noratlas, but with a maximum all-up weight of 41,500 lb, a wing loading of 37.3 lb/sq ft, a cruising speed at 5,100ft of 187 m.p.h. and a range of 1,416 miles. Two Bristol Hercules 738s giving 2,080 h.p. for take-off were specified, and the aircraft would have carried 40 to 53 passengers or 42 parachutists or 58 troops.

This design was, however, discontinued and work concentrated on the C.A.S.A. 207 Azor, the first prototype of which flew last September. It has since completed about 25 hours in the air and the second prototype should fly during the next few weeks. The engines are two Bristol Hercules 730s, giving 2,080 h.p. at take-off. With a maximum weight of 33,100 lb this is the largest transport that C.A.S.A. have designed and built to date. It is intended as a civil aircraft, possibly for use as a replacement for Dakotas, Freighters and Languedocs in service with the Spanish airline companies Iberia and Aviacion y Comercio.

The structural simplicity of the Alcotán and Halcón has been

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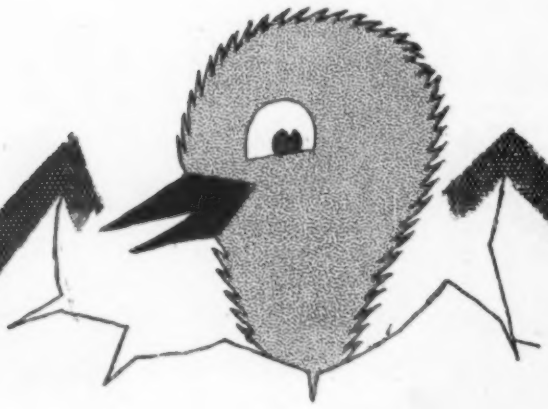

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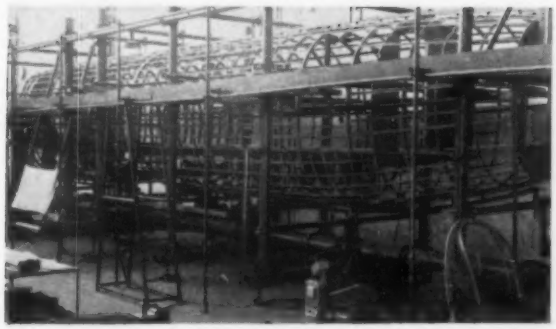
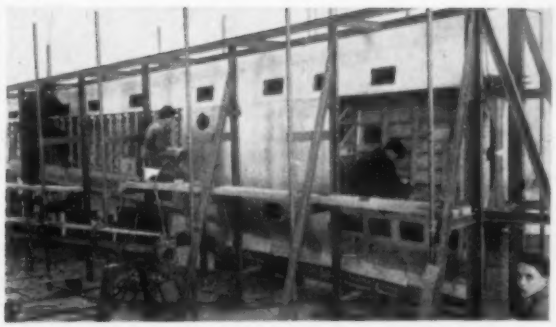
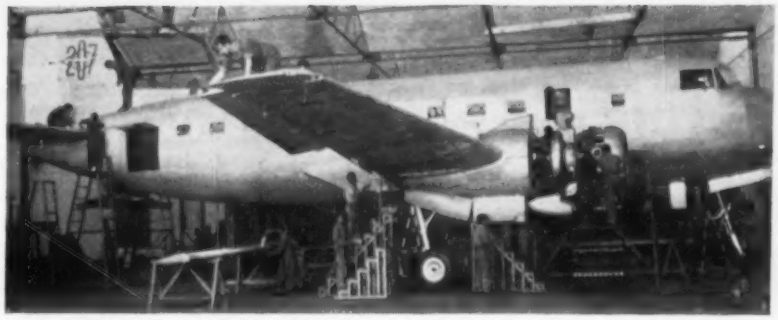






The latest C.A.S.A. transport is the 207 Azor, the first prototype of which is shown (right) nearing completion last year. It has now flown some 25 hours. The second prototype should fly during the next few weeks. Above, left and right, are the fuselage and outer wing of the Azor in their jigs. The structure is light and simple and quite conventional.

MADE IN SPAIN . . .

maintained in the Azor. The fuselage, for example, is a perfectly plain classic monocoque without keel or main longerons. The cabin is unpressurized and the main entrance door suitable for passengers and small freight only. A freight compartment with a large square hatch on the starboard side is located aft of the passenger cabin. There is provision for 30 first-class or 38 tourist passengers. Azors eventually ordered for the Spanish Air Force could be fitted for airborne operations, crew training or ambulance work, but so far neither civil nor military orders have been placed and figures relating to cost of operation are not yet available. The aircraft has yet to be officially evaluated.

Principal figures on the Azor are: span and length, 93ft and 67ft 5in; wing area, 923.5 sq ft; aspect ratio, 9; maximum wing loading, 35.6 lb/sq ft; and maximum load, 11,400 lb. Maximum speed at 5,050ft is 264 m.p.h. and cruising speed at 64 per cent power at 9,950ft is 218 m.p.h. The service ceiling is 25,400ft. Comprehensive instrumentation to assess actual performance figures is now being installed in the first prototype. It is hoped eventually to be able to raise the cruising speed to between 250 m.p.h. and 257 m.p.h., and the aircraft is considered suitable for Spanish internal routes and for traffic in Europe generally.

The Getafe factory is at present being to some extent enlarged in preparation for production of bigger aircraft and for the I.R.A.N. work (Inspection and Repair As Necessary) on the F-86F Sabres which are now coming in. Minor overhaul work is also being done on U.S.A.F. C-47s. Under German licence 100 or more Junkers Ju52s were built at Getafe some time ago and some replacement E.N.M.A.S.A. Elizalde Beta 750 h.p. powerplants for them are still being made.

The Dornier Do25 was designed in Spain by a team headed by Claudius Dornier, Jr., and built by C.A.S.A. to Spanish government order. The machine shown here is the first prototype, powered by the 150 h.p. E.N.M.A.S.A. Tigre G.IV.B.

One of C.A.S.A.'s most interesting tasks to date has been the construction of the two prototypes of the German Dornier Do25 liaison aircraft. The design was prepared at the Oficina Tecnica Dornier in Madrid under the personal supervision of Claudius Dornier, Jr., and construction work was subcontracted to C.A.S.A. The first machine had the Tigre G.IV.B engine of 150 h.p. and the second had a 220 h.p. Continental. The former aircraft is now in the Spanish government aircraft test centre while the second has been shipped to Germany, where it has several times been referred to as the Dornier Do27. C.A.S.A. states, however, that the Dornier 27 may well turn out to be somewhat larger than the 25 and will have a Lycoming engine of some 270 h.p. The Lycoming has apparently been specified because of the projected construction under licence in Germany of the Piaggio P. 149, which has a Lycoming engine.

The Do25 is of all-metal construction, and by reason of the layout of its main members has a rather ungainly appearance. The fuselage is built up around a hefty frame which carries the wing attachments and undercarriage legs and locates the four longerons which are the principal structural members of the cabin section. The longerons converge at the nose to form the engine bearers and at the rear of the cabin merge into the monocoque tail cone. By this means the designers have been able to provide very large doors, each framing ample transparencies. The undercarriage legs are faired and have plain compression oleos, and wheel brakes on the first machine are cable operated through toe pedals. The fin is all-metal while the rudder is fabric-covered, as are also the elevator, ailerons, flaps and the wing aft of the main spar. The main spar of the tailplane is well forward and pivoted to the fuselage, incidence being controlled by a screw-jack located in line with the elevator hinge. An ample slot over the total leading edge of the wing is backed up by very small double slots on the flaps and ailerons. Fuel is carried in two underwing tanks whose float-type contents gauges are set in glass tubes which form the leading edge of the supporting pylons. The cabin layout is flexible to accommodate a variety of loads ranging from three passengers and pilot to a stretcher or cameras. On the whole the structure looks as if it might be rather heavy. The nose section, however, is obviously designed to accommodate a variety of engines and the original Spanish government requirement did indeed specify a 150 h.p. Tigre in the first machine and a Continental or Lycoming of well over 200 h.p. in the second. Very little information on the Do25 was available in Spain, and it appears that the whole project has been quite firmly taken back to Germany. This may not prevent production in Spain, however, as C.A.S.A.'s Seville factory is reported to be preparing to quote for the construction under licence of the Do27.

(*To be continued*)

THE INDUSTRY

Prizes for Blackburn Apprentices

PRESENT at the twenty-fifth successive annual apprentice prize-giving of Blackburn and General Aircraft at the Guildhall, Hull, were the Lord Mayor and Sheriff of Hull; directors and officials of the company; local educational officials; the apprentice supervisors of A. V. Roe, Vickers Armstrongs, Scottish Aviation and Blackburn (Dumbarton), Ltd., and the apprentices and their parents.

Mr. Eric Turner, chairman and managing director, who presided, said that although Blackburns had been presenting prizes for 25 years the training of apprentices had gone on for longer than that; the company was the first in the British aircraft industry to recognize the merit of apprentices in this manner. At present there were at Brough 368 apprentices of different grades, and together with others at Leeds and Dumbarton there was a grand total of approximately 500 in the Blackburn group. Mr. Turner referred also to the help received from the educational authorities and in particular from the Principal of the College of Technology in Hull.

Mr. N. E. Rowe, Blackburn technical director, said aeronautical engineering had very definite characteristics of its own which made great demands on the personnel concerned; there were more opportunities today than ever there were in the past, but they would not come to those who sat and waited; they had to be worked hard for.

Mr. T. A. Wolstenholme, apprentice supervisor, said in his report that seven students had qualified for the Higher National Diploma in aeronautical engineering; two had obtained the B.Sc. (engineering) degree; one gained the Higher National Certificate; and four had obtained City and Guilds intermediate certificates.

Mr. Turner then presented prizes to 114 successful apprentices. The Robert Blackburn Memorial Prizes went to L. R. Jenkinson (£50), K. Farrance (£50), J. G. Joyce (£25), and B. Maskew (£25). The directors' prize to the best all-round craft apprentice of the year—an engraved wrist-watch—was presented by Mr. T. Bancroft (production director) to apprentice P. Yates.

A.F.C.E.A. Visit Decca

OVER 100 members of the London Chapter of the Armed Forces Communications and Electronics Association attended a recent meeting at New Malden, as guests of the Decca Radar and the Decca Navigator companies.

Among those present were Brig. Gen. S. M. Thomas (president, A.F.C.E.A.), Vice-Admiral J. W. S. Dorling (director, Radio Industries Council), Lt-Col. J. P. Tyler, Mr. Leslie Hinton, Capt. H. E. Ruble and Lt-Col. N. Fertig (vice-presidents of A.F.C.E.A.), Mr. H. F. Schwarz (managing director, Decca Navigator Co.), G/C. E. Fennessy (managing director, Decca Radar), and Mr. S. R. Tanner (research director, Decca Radar).

The evening's programme included an exhibition of radar and navigational equipment, and, following dinner, the showing of films on the Decca Navigator helicopter equipment and the Decca storm-warning radar.

MODEL FACTORY: Air Marshal Sir Thomas G. Pike, Deputy Chief of the Air Staff, recently visited the Chadderton and Woodford factories of A. V. Roe and Co., Ltd. With Sir Roy Dobson (managing director), centre, and Mr. J. A. R. Kay (director and general manager), he studies a model showing the layout of the Chadderton plant.

ABILITY REWARDED: Mr. Eric Turner, Blackburn chairman, presents one of the Robert Blackburn Memorial Prizes to apprentice J. G. Joyce. *(See Col. 1.)*

Mr. Harold Tippetts

WE regret to learn of the death, at the age of 67, of Mr. H. A. Tippetts, chairman and managing director of L. H. Newton and Co., Ltd., of Nechells, Birmingham. After going into partnership with Mr. L. H. Newton he acquired the company in the 1920s and speedily built it into a first-class manufacturing unit, only to see his work destroyed by a fire in 1937; and a new factory completed just before the war was destroyed by enemy action in 1941. Nevertheless, production was restored within a month by the use of dispersed factories, and the firm was able to claim that it supplied over half the bolts and other small precision fastening components required by the aircraft industry; work of this kind continues today. Mr. Tippetts leaves a widow and a son, Mr. Stanley Tippetts, who with his father jointly managed the family companies.

Electronics Industry's Contribution

AT the annual luncheon of the Radio Communication and Electronic Engineers Association, held recently in London, it was stated that the radio and electronic sections of the radio industry were estimated to have been responsible for approximately one-third of the total volume of the radio industry's overall output, which was believed to exceed £220m a year.

This included, of course, defence equipment, the importance of which was indicated by the fact that the 1955-56 Air Estimates earmarked £23m for electronic equipment. The Royal Navy and the Army spent rather less, but it was significant that the electronic equipment in a current aircraft carrier was estimated to be worth £1m. The value of direct exports in 1955—those excluding equipment already installed in ships, aircraft, etc., sold to countries abroad—was estimated at a record figure of more than £13m.

IN BRIEF

Following the supply of a very large dual-voltage ground power unit to A. V. Roe, Ltd., for starting Vulcans, Petbow, Ltd., have now delivered an even more powerful starter to them. This unit, the GSU 109, is powered by a Rolls-Royce six-cylinder engine and gives 2,000 amp at 28 volts and 1,000 amp at 112 volts.

* * *

From G.W.B. Furnaces, Ltd., Dibdale Works, Dudley, Worcs, come new leaflets describing their range of mains-frequency induction-melting equipment. The furnaces available cover the basic materials cast iron, copper alloys, and light alloys.

* * *

From Wolf Electric Tools, Ltd., Pioneer Works, Hanger Lane, London, W.5, come details of a belt sanding-attachment designed for fitting to their type GQ6 six-inch high-speed heavy-duty grinder. The abrasive belt, which is 2in wide by 2ft long, runs (under a light load) at 6,000ft/min.

* * *

Rubery, Owen and Co., Ltd., announce the appointment of Mr. P. S. Walkins, D.F.C., A.L.A., formerly librarian at B.O.A.C., to the position of librarian and information officer in charge of the Owen Organization library and information service. This division is part of the research and development department at Darlaston, South Staffs, and supplies the group with information on production, technical, commercial and research matters.

This striking study of the Caravelle was secured on a recent "high-incidence" take-off from Toulouse-Blagnac. Leading-edge flaps are drooped and the main flaps partly extended; stoneguards, just discernible, have been fitted to the rear bogie-wheels to protect the Avon intakes.

CIVIL AVIATION

LORD BRABAZON'S PRESCRIPTION

SPEAKING as "the looker-on who sees most of the game," Lord Brabazon of Tara put forward a motion in the House of Lords on February 1st drawing attention to "the unsatisfactory situation existing today relative to the building of commercial aircraft in this country." Lord Brabazon recalled that after the war a "very talented committee," of which he had been made chairman, was set up by the Air Minister and the Minister of Aircraft Production to express users' requirements as to future civil aircraft to be built.

Recommendation No. 1 was for a machine that could fly between London and New York non-stop either way. It had not been for the committee to say whether the machine should be built or who should build it. Lord Brabazon had always considered it "a somewhat strange piece of forward planning" that the Minister of Aircraft Production at the time decided to have the machine built without asking who wanted it or who was prepared to use it. Lord Beaverbrook had referred to the machine as the Brabazon and the name had stuck, but Lord Brabazon could not say that he enjoyed being associated with its extraordinary career.

Referring to the Princess, Lord Brabazon said that the committee did its best to get users to recommend that a big flying-boat should be constructed, but that no operator was prepared to join in such a recommendation. The Ministry of Supply had taken a different view, and Lord Brabazon congratulated them on their vision and initiative in ordering three. He felt it was a pity, however, that the Ministry ordered the same engines as were scheduled for the Brabazon: "They must have known that the firm were quite incapable of producing them." Princesses might have been used by British South American Airways, but the Corporation was merged into B.O.A.C., "who definitely refused to have anything to do with this aircraft."

He next questioned the wisdom of the decision to cancel the V.1000 and asked whether it was the future policy of the Corporations to run tramps instead of airliners.

Describing the story of the Brabazon, Princess and V.1000 as a piece of "rag-time forward planning," Lord Brabazon said, "I accuse no party . . . no individual of being to blame." For the future, he made four recommendations.

Transport Command, he urged, should pioneer new civil types of machines. They, in conjunction with the operators, would then develop these aircraft. "My second recommendation," said Lord Brabazon, "is that there are too many aircraft firms." This wanted attention from the Ministry of Supply, to see that not more than four or five should exist. Third, he would like to see it laid down that in ten years time the corporations should fly wholly British machines. Finally, no order should be given for a great civil machine until the following agreed to co-operate and operate it: The Air Ministry, the Ministry of Supply, the Ministry of Civil Aviation, the Corporations and the independent operators joined with the great shipping lines. There should also be a committee presided over by a cabinet minister with two colleagues, one a member of the Opposition ("so as to keep continuity"), the other an experienced civilian.

Replying for the Government, the Earl of Selkirk pointed out that there was already a Transport Aircraft Requirements Committee, which met at the Ministry of Supply. On it were senior representatives of the Air Ministry, Admiralty, M.T.C.A., the Treasury, M.o.S. and the Corporations.

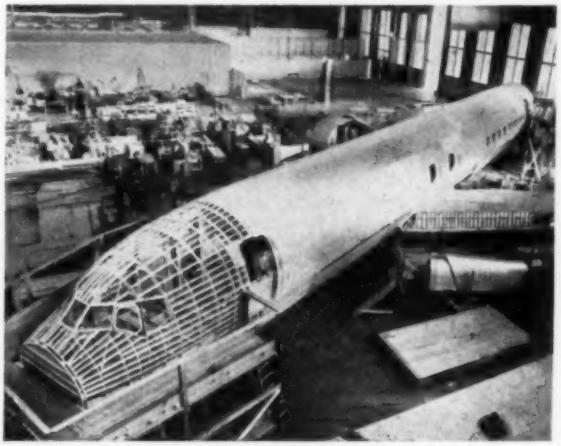
K.L.M. JOIN ELECTRA QUEUE

FOLLOWING the visit of K.L.M.'s president, General Aler, to the United States last month, comes news that the airline has placed an option on ten Lockheed Electras. The general said that there was "a very good chance" of his placing a firm order—which would be the first outside the U.S.—since Lockheed were offering delivery in 1959. K.L.M., who have an order for nine Vickers Viscount 803s, must also be regarded as a potential purchaser of Vanguards. Electra customers to-date are American (35), Eastern (40), Braniff (9), National (20).

EXIT THE JOURNEY LOG-BOOK

A WELCOME move to reduce the amount of paper work done by civil operators and airliner crews is the abolition, just announced by the Ministry of Transport and Civil Aviation, of aircraft journey log books. Entries previously made in log books are already included in the General Declaration—carried on all international flights—the standard clearance document for all customs, immigration and health control purposes which, unlike the log book, enables copies to be submitted simultaneously to the different authorities. In recent years the General Declaration, as prescribed by I.C.A.O. after the war, has become the accepted document for the clearance of aircraft in and out of all airports. Furthermore, the use of the journey log book for operational purposes has given way to the procedure whereby separate aircraft defect and maintenance records are kept. This is in accordance with the Air Navigation Order requiring an airframe log book, one for each engine and propeller, a telecommunications log book, and a record of flying hours and defects.

A full-scale plywood mock-up of the Douglas DC-8 is taking shape at Santa Monica. The mock-up, which cost £89,000, will have only one wing but is "complete" in most other respects.



Training of crews for B.O.A.C.'s Britannias in preparation for their introduction to service later this year is now under way at Hurn. Instructors and pupils shown here are (left to right): Captains F. C. Hill, K. J. Loveless, F. W. Walton (who is in charge of training), J. T. A. Marsden, J. J. Veasey and First Officer M. A. Eyre.

CIVIL AVIATION . . .

DC-8s FOR SWISSAIR—

SWISSAIR become the second European airline—the first was S.A.S.—to place an order for the Douglas DC-8. The company announced on January 31st that negotiations had been completed with Douglas for the delivery of two aircraft during the first half of 1960. Total cost including spares is £5,830,000, on which £291,500 has already been deposited. Swissair's order continues an association with Douglas going back 20 years, starting with the DC-2 and subsequently the DC-3, DC-4 and DC-6B. Four DC-7Cs are due for delivery starting later this year.

Swissair will use their DC-8s on the transatlantic route flying direct from Zurich and Geneva to New York in eight hours westbound and seven and a half hours eastbound.

—AND LUFTHANSA CONSIDER 707 OR DC-8

BY the time these words are read it is likely that Lufthansa, having decided in principle to order four U.S. jet airliners as part of its 1960 expansion programme, will have made a choice between the Boeing 707 and the Douglas DC-8. The airline is at present negotiating with the Federal German Treasury, which holds more than 80 per cent of Lufthansa's share capital, for financial assistance in a projected expenditure of some £17m. It is understood that this sum includes the purchase of new medium-haul airliners, and the purchase of seven Viscount 800s is being considered.

LESSONS TO BE LEARNED

OF vital interest to all pilots, an M.T.C.A. survey* of major civil accidents to British aircraft during 1954 was published last month. It shows that accidents occurred to 93 aircraft, fatalities occurring in 14 cases. Of these, 62 accidents involved light aircraft, nine of which proved fatal.

The brief summaries of the circumstances of each accident form the most valuable part of the review. Every C.F.I. with any interest at all in what his pilots do to his club's aircraft will make sure that these summaries are read, and re-read, by all club members. Private owners also should learn them by heart. The unexpected occurrences, and those which are so familiar yet are repeated year after year give equally emphatic warnings.

Public transport aircraft were involved in 13 accidents (four of which were fatal), during the year, "pilot error" being listed as the apparent cause in eight cases. Six of these accidents occurred during the approach and landing phase.

The total number of accidents to light aircraft (62) showed a small decrease compared with 1953. Despite an increase in the number of current Student Pilots' Licences, only 14 student pilots were involved in accidents—less than half the previous year's figure. One noticeable trend, according to the Ministry, was the sharp increase in accidents resulting from inattention to, or lack of knowledge of, the fuel system. Once again inadequate flying speed had led to a number of stalling and spinning accidents. This, coupled with misjudgement of distance and failure to level off properly on landing, continued to form the predominant factor in light-aircraft accidents. Two serious accidents had occurred to single-engined machines because the pilots attempted to return to the aerodrome when the engine failed immediately after take-off. During the year under review seven accidents to gliders and three to helicopters were reported, but in no case with fatal results.

"A Survey of the Accidents to Aircraft in the United Kingdom in the Year Ended 31st December, 1954." Published by Her Majesty's Stationery Office for the M.C.A., price 2s.

BREVITIES

THE new "Skyport" exchange at London Airport came into operation on January 28th. Among the new telephone numbers now obtainable are SKYport 4321 (M.T.C.A.), 5511 (B.O.A.C.) and 3131 (B.E.A.).

* * *

B.E.A. have confirmed that water-contaminated fuel brought about the emergency landing of a Viscount near Bordeaux on January 2nd. Tests showed that fuel taken on at Gibraltar were contaminated with salt water.

* * *

Czechoslovakia is reported to have offered to build the proposed new airport at Al Marja, six miles from Damascus. The same source says that Swissair, K.L.M. and S.A.S. have also made a joint proposal to build the airport in return for ten years' exploitation of it.

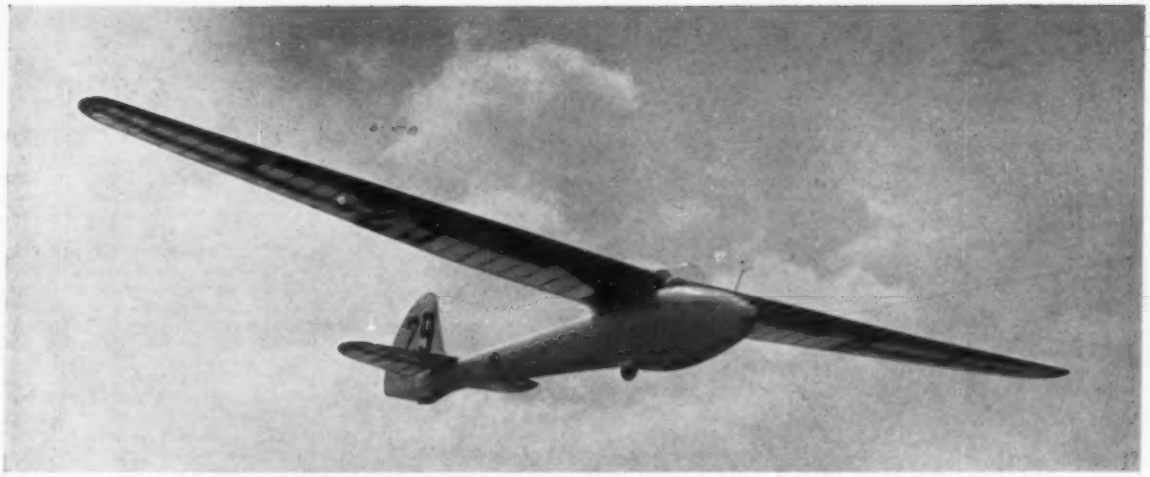
* * *

Seaboard and Western Airlines carried 2,563 tons of transatlantic freight in 1955—an increase of 33 per cent on the 1954 figure. The airline is believed to be awaiting British Government approval to operate scheduled transatlantic freight services, for which it was certificated by the C.A.B. last year.

* * *

A proposal by North American Airlines to operate scheduled passenger services between the United States and Europe at fares 50 per cent below I.A.T.A. rates has been rejected by the C.A.B. Even in the unlikely event of C.A.B. approval, few if any European nations would have considered awarding the necessary traffic rights. When the proposal was first announced, T.W.A. described it as "such a transparent publicity stunt that it warrants no serious consideration."

Leading personalities present at the recent inauguration of Air Austria were (left to right): Dr. E. van Konynenberg, vice-president, K.L.M.; Baron O. von Reichel von Erlenhorst, of the Austrian Air Traffic Research Institution; and Dr. M. Kink, Dr. H. Lauda, president and vice-president of Air Austria. The model bears out reports that, pending delivery of their Viscounts, Air Austria will begin operations with DC-4s leased from K.L.M.



A major achievement in Service gliding during 1955 was the winning of the Kemsley Cup at the National Gliding Championships by the R.A.F.G.S.A. "Moonrakers" Club, whose Gull IV (above) received the greatest number of team-class points. The R.A.F.G.S.A. annual meeting is reported below.

CLUB AND GLIDING NEWS

FAIR OAKS Aero Club, with its fleet of three Autocrats and seven Tiger Moths, logged a record total of 4,464 flying hours during 1955, of which 1,761 were flown by members of the Vickers-Armstrongs Club. Of the 83 Private Pilots' Licences obtained, 43 went to Vickers members and 11 to A.T.C. scholarship cadets. Hours flown by cadets and on pleasure flights were 328 and 61 respectively. Two full-time and four part-time flying instructors are employed at the club, membership of which (including 60 Vickers members and 20 temporary members) stands at over 300. During last year, 30 C. of A. overhauls were carried out, 24 privately owned machines being based at Fair Oaks.

HAVING been associated with club flying in Yorkshire for 27 years, Capt. H. V. Worrall, O.B.E., manager of the Yeadon Aero Club, now intends to retire and return to his native Australia. He came to this country in 1914, served in the R.N.A.S. during the war, and later worked for the Blackburn Aeroplane Company. In 1927-8 he was co-pilot to Sir Alan Cobham on his Short Singapore flight around South Africa. He was manager and C.F.I. of the Yorkshire Aeroplane Club from 1929 to 1939, and during the Second World War became Avro's chief test pilot at Yeadon, later joining the Lancashire Aircraft Corporation there as manager. He took up his present post as manager of Yeadon Aviation, Ltd., and Yeadon Aero Club in 1952.

A testimonial fund for Capt. Worrall, opened by the club last month, has already raised some £200.

FOR the various clubs operating from what has become known as the Lasham Gliding Centre, Hampshire, 1955 was another record year. The number of launches and hours flown were 18,248 and 2,730 respectively, both totals and the resulting average flight-duration showing substantial increases over those for the previous year. Club, private, and B.G.A. Test Group gliders and sailplanes accounted for 17,190, 991 and 67 launches respectively, and the mileage flown on cross-country flights totalled 4,227. These figures do not include the flying performed during the 1955 National Championships at Lasham.

During the year, the following records were broken from Lasham: Derek Piggott, U.K. local absolute height for single-seaters; Lorne Welch and Frank Irving, British two-seater distance and U.K. local 100km triangle speed for two-seaters; Wally Kahn and Bruce Sinclair, U.K. local 100 km speed for two-seaters; A. Sanders and Stuart Morison, British two-seater absolute and gain of height for two-seaters; Mrs. Rika Harwood, British women's single-seater distance; and Mrs. Anne Burns, British women's single-seater distance.

The B.G.A. Test Group at Lasham tested the Skylark 3 during 1955, and the B.G.A. approved the formation of its No. 1 Instructors' School there. The permanent staff at the centre now totals ten people. The intention is to expand operations at Lasham threefold; this cannot be done at present, however, because of the insecurity of tenure imposed by the Air Ministry. The position remains, deplorably, that all gliding operations at Lasham can be closed down at only one month's notice.

AT the recent annual general meeting of the R.A.F. Gliding and Soaring Association, A. Cdre. G. J. C. Paul, founder and retiring chairman, reported that the Association now had a membership of over 600 in its eight member-clubs. Flying activity had continued to increase in 1955: 1,479 flying hours and 16,082 launches had been accomplished during the year. For 1956, the target is 1,000 members, 2,000 hours and 20,000 launches. Forty-two R.A.F.G.S.A. flying scholarships, enabling Service personnel to glide at civilian clubs, have been awarded to date, and £300 is to be set aside for this scheme during 1956. At the meeting, A. Cdre. D. W. Lane was elected chairman of the Association, and W/C. N. W. Kearon vice-chairman.

COVENTRY AEROPLANE CLUB flew a total (members and A.T.C. cadets) of 772 hours during 1955. There is every prospect of increasing this total during this year, the club reports, as the two Tiger Moths are fully serviceable and have been joined by the club's Auster Autocrat, newly converted to Gipsy Major power. Members of the Armstrong Siddeley and Armstrong Whitworth Flying Groups and the Coventry Gliding Club have recently been admitted as associate members of the C.A.C. Mrs. Hustwayte, wife of the C.F.I., is now stewardess at the club.

RECOGNITION CONTEST WINNERS

A RECORD entry of 75 teams competed in the ninth All-England Aircraft Recognition Contest, held at the Royal Institution, London, on January 21st.

The Silver Hurricane Trophy, awarded to the team with the most marks, went to No. 2 Group Post Q.3, R.O.C., Wallington, Surrey, who scored 83 points. The team consisted of Observers M. N. Jamieson, M. J. Hooks and J. W. Ware. A team representing Registration Research was second, with 80 points, and the South West Essex Branch of Air-Britain was third with 79.

The *Air Pictorial* Trophy for the highest individual score was won by Ldg. Obs. R. F. Bass, No. 8/P.4, Hinckley, Leicester. He achieved the remarkable figure of 32 points out of a possible 35 in what was undoubtedly the most difficult contest yet devised in this series. Tying for second place were M. M. Gates, representing the Aircraft Recognition Society, and O. M. N. Jamieson, both with 30 pts. The B.E.A. Viscount Trophy for the top Service team was won by R.A.F. Lyneham with 74 pts. (L.A/C. A. Geffen, L.A/C. A. G. Masson and A/C. M. Williamson). Second were Waterbeach and third Odiham. No. 4F (Ilford) Sqn. won the Handley Page Heracles Trophy, for the best A.T.C. team, with 66 pts. (Cpl. R. Slater and Cdts. R. Dann and R. Holmes). Second were No. 14F (Uxbridge) Sqn., 65 pts., and third No. 1101 (Kettering) Sqn., 64.

Mr. Peter G. Masefield, managing director of Bristol Aircraft, Ltd., and president of the Aircraft Recognition Society, presented the trophies. Capt. O. P. Jones, C.V.O., O.B.E., umpired the contest and, while the papers were being marked, gave an account of his experiences during 33 years as an airline captain.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

Ski Championships

TRAINING is now under way for the R.A.F. Ski Championships, to be held at Zermatt on February 22nd and 23rd. These competitions will be followed by the Inter-Service Championship on March 1st and 2nd at St. Moritz. Six officers and airmen, ranging in rank from group captain to corporal and in trade from fighter pilot to electrician, have travelled from Britain to Switzerland under the auspices of the R.A.F. Ski and Winter Sports Association. They were to be joined later by eight other competitors from 2nd T.A.F. in Germany. The R.A.F. team to meet the Army and Navy is being chosen from these men.

Naval Trophies for Valiants

ON Wednesday last week Admiral the the Earl Mountbatten of Burma, the First Sea Lord, was to present trophies on behalf of the Board of Admiralty to the first three Valiant squadrons, at a dinner at H.Q. Bomber Command, High Wycombe. The trophies, in the form of silver tankards from the wardroom of the battleship H.M.S. *Valiant*, were being accepted on behalf of the Valiant squadrons, Nos. 138, 214 and 543, by A.V-M. E. C. Hudleston, A.O.C. No. 3 Group. Members of the Board of Admiralty, former captains of H.M.S. *Valiant*, members of the Air Council and Air Marshal Sir Harry Broadhurst, A.O.C-in-C. Bomber Command, were on the guest list, as well as the squadron and flight commanders of the V-bomber units.

H.M.S. *Valiant* was built during the 1914-18 war and was engaged in many famous actions during World War 2. She was finally scrapped in 1948. The silver tankards had been presented to the ship's wardroom by officers who had served in her at various periods during her commission.

No. 138 Sqn. (W/C. R. G. W. Oakley, D.S.O., D.F.C.), based at Wittering, was the first squadron to receive Valiants. It was formed in 1918 and reformed during World War 2, when it was employed mainly on "cloak and dagger" operations to support partisans all over the Continent. No. 214 Sqn. (W/C. L. H. Trent, V.C., D.F.C.) is based at Marham. It was originally No. 14 Sqn., R.N.A.S., but, after renumbering, flew Handley Page 0/400s on night bombing operations over Germany. In World War 2 it was for some time engaged in radio counter-measures with Fortresses and took part in the famous radar "spoof" operation on D-Day. No. 543 Sqn. (W/C. R. E. Havercroft, A.F.C.) is based at Wyton. During World War 2 it was a P.R.U. unit and, among many other operations, took photographs of the Möhne and Eder dams immediately after the attack by No. 617 Sqn. had been completed. No. 543 was disbanded in October 1943 and reformed last April.

The Royal Tournament

PARTICIPATION of the R.A.F. in the Royal Tournament which will be held at Earls Court, London, from June 6th to 23rd will include a display of log rolling by 64 men of the School of Physical Training, a demonstration by 32 police dogs and, in addition, 50 airwomen will take part in a display of rhythmic running and dance movements by a combined team of 150 members of the women's services. Several Service bands will play and a number of mascots will appear including Air Dog "Comet," L.A/C. Hamish McCrackers, the skewbald Shetland pony mascot of the R.A.F. Apprentices School at Locking and Cpl. Lewis II, the goat mascot of R.A.F. Halton.

Three New Badges

BADGES for three R.A.F. stations have recently been approved by the Queen. They are for Upwood, Stradishall and Lyneham. The badge for Upwood, a bomber station, includes a clump of oak trees, recalling the oaks in the neighbourhood in which Charles II once hid. A rampant lion is taken from the arms of Oliver Cromwell. The motto is "*Pro Aris et Focis*" ("For Hearth and Home").

The badge of Stradishall, a fighter station, is "a birdbolt and an arrow in saltire enfiled by a circlet." The birdbolt and arrow represent the various weapons used by fighter aircraft and the circlet suggest the station's function in looking after its squadrons. The motto is "*Vires de Coelo*" ("Strength from the Sky").

Lyneham, a transport station for almost 15 years, has a badge showing a comet encircling a terrestrial globe, the comet indicating the aircraft of that name which will operate from the station later this year. The motto is "Support, Save, Supply."

The F.A.A.'s Boyd Trophy

THE Boyd trophy for 1955 has been awarded to No. 806 Sqn. which was the first F.A.A. unit to be equipped with Hawker Sea Hawks. The trophy has been awarded for "maintaining the highest standards of day and night flying and efficiency throughout the squadron's commission in H.M.S. *Centaur* and for the excellence of its aerobatic teams and the brilliant individual performances of its commanding officer, Lt-Cdr. D. P. W. Kelly, R.N. No. 806 Sqn. was disbanded last November.

The Boyd trophy commemorates the work of Vice Admiral Sir Dennis Boyd who, as captain, commanded H.M.S. *Illustrious* during the Taranto attack.

Reunion

THE ninth reunion of No. 1 S.F.T.S. (1) Ambala will be held on February 18th at the Chevrons Club, Dorset Square, Baker Street, London. Tickets, price 14s 6d single and 19s double, obtainable from Stan Booth, 31 The Highlands, London N.4.

Early flight tests of the Vickers-Supermarine N.113 were made at Boscombe Down. The views here show deputy chief test pilot "Mike" Lithgow being strapped in (left) before taking off with a Swift F.R.5 escort (right).

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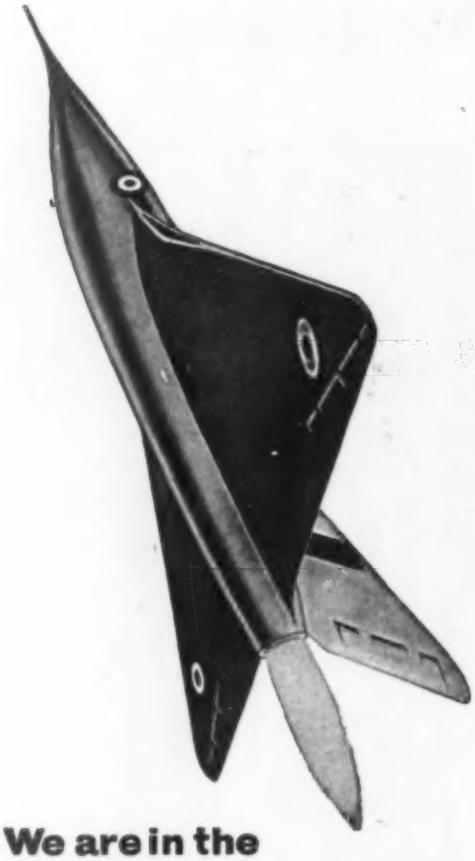

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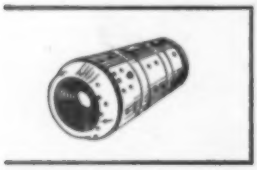

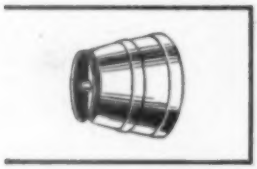

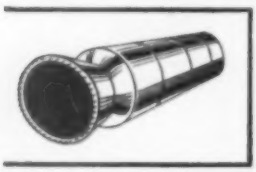

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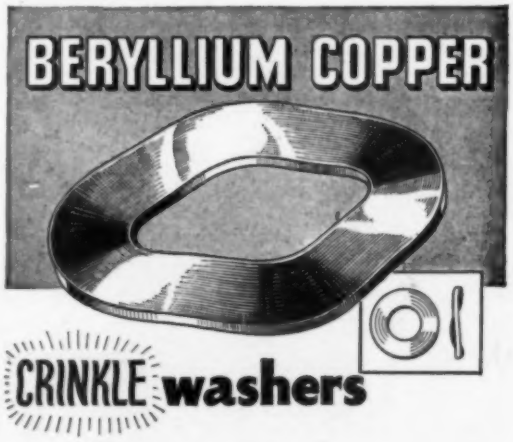

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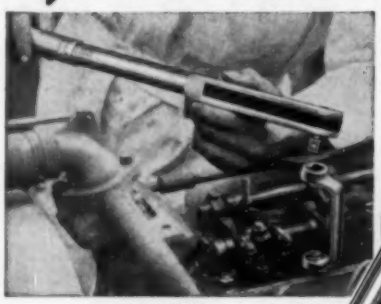

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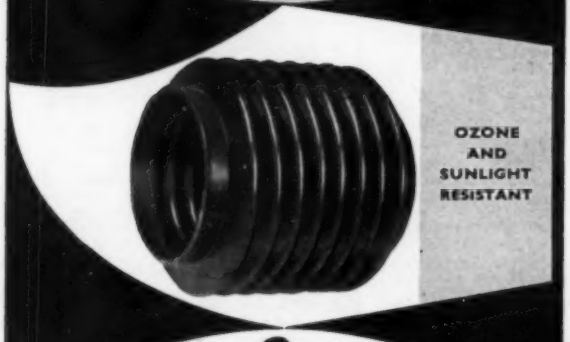

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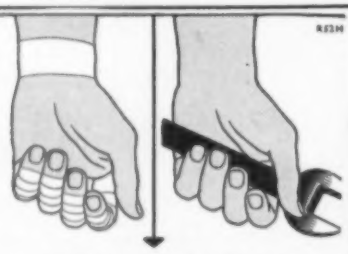

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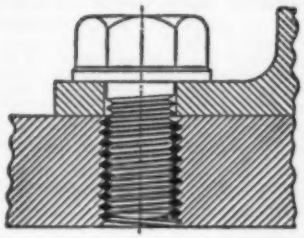

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AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled air services:—

FROM Starways Ltd., of Liverpool Airport, Liverpool 19, for the following Seasonal Inclusive Tour Services to be operated with Dakota aircraft for the carriage of passengers in conjunction with The Cathedral Touring Agency, Liverpool, on behalf of Liverpool City Caterers:—

APPLICATION No. 715. For a service between Liverpool (Speke) and Exeter at a frequency of from one to two return flights weekly during the season from May to October inclusive each year for a period of 10 years commencing May 1956.

APPLICATION No. 716. For a service between Leeds (Yeadon) and Exeter at a frequency of from one to two return flights weekly during the season from May to October inclusive each year for a period of 10 years, commencing May 1956.

APPLICATION No. 717. For a service between London and Exeter at a frequency of from one to two return flights weekly during the season from May to October inclusive each year for a period of 10 years commencing May 1956.

APPLICATION No. 718. From Dragon Airways Ltd. of Newcastle Municipal Airport, Woolsington, Newcastle-upon-Tyne, 3, supported by Hunting-Clan Air Transport Ltd., for permission for Dragon Airways Ltd. to take over from Hunting-Clan Air Transport Ltd. the following Normal Scheduled and U.K. Internal Services which have been authorised for operation by the latter Company during the period up to 31st March, 1960:—

Type of Service	Route	Application No.
U.K. Internal	Newcastle-London.	89
U.K. Internal	Newcastle-Manchester.	90
U.K. Internal	Newcastle-Edinburgh (optional stop)-Glasgow (Renfrew).	91
Normal Scheduled	Newcastle-Stavanger and/or Bergen (optional stop)-Oslo-Stockholm.	92
Normal Scheduled	Newcastle-Hamburg and/or Copenhagen.	93
Normal Scheduled	Newcastle-Amsterdam-Dusseldorf.	94
Normal Scheduled	Newcastle-Brussels (optional technical stop)-Zurich	95
Normal Scheduled	Newcastle-Paris	96
U.K. Internal	Newcastle-Glasgow (Renfrew) (optional stop)-Belfast (Nutts Corner).	225

DRAGON AIRWAYS LTD. ask for permission to operate the above services in accordance with the terms of the existing approvals, which provide for the use of Dakota, Viking, Viscount and/or DH. Heron aircraft, with the following exceptions:—

(a) The services Newcastle-Manchester, Newcastle Edinburgh (optional stop)-Glasgow and Newcastle-Zurich are not to be operated initially.
(b) Application No. 89/2: The Company request an increase in frequency to three return flights per day on the Newcastle-London service.
(c) Application No. 92/4: The Company request permission to operate Newcastle-Bergen only and not Newcastle-Stavanger and/or Bergen (optional stop)-Oslo-Stockholm.
(d) Application No. 93/2: The Company request alteration of route Newcastle-Hamburg and/or Copenhagen to Newcastle-Amsterdam-Hamburg.
(e) Application No. 94/2: The Company request an increase of frequency of up to seven return flights per week on the Newcastle-Amsterdam-Dusseldorf service.

THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on 30th July, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3, Dean's Yard, London, S.W.1., from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [4808

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The Personnel Manager, Hargher Clough Works, Burnley

SITUATIONS VACANT

AIRCRAFT Section Leader Design Draughtsmen required. Salary according to age, experience and qualifications up to £900 per annum.
Pension Scheme/Superannuation Fund in operation.
Write or 'phone: Baynes Aircraft Interiors Limited, LANGLEY AERODROME, Bucks.
Telephone: Langley 451 [4766

ROCKET Division of Armstrong Siddeley Motors has following vacancies for Mechanical Engineers with qualifications stipulated:
(1) Mechanical Engineering Graduates or equivalent required for work connected with design and development of test equipment for liquid propelled rocket engines. This work covers a wide range of engineering problems, and offers good prospects to men of the right calibre.
(2) Electronic Engineers for work on design and maintenance of electronic recording gear in connection with testing of engines. Applicants for these positions should hold at least a H.N.C. in Electrical Engineering and have some experience of electronic apparatus. The positions are on the Technical Staff and pensionable. Good working conditions. Free transport from Coventry to works and canteen facilities. Application quoting reference RD/Mech or RD/ Elect as appropriate to Technical Personnel Manager, Armstrong Siddeley Motors, Coventry. [0464

MORTON AIR SERVICES, Croydon (CRO 7171), invite applications for vacancies, Radio Officers. First class licences. Service home and overseas. [0014

PILOT required for summer schedule service & club instructing. Min. Req. CPL & IR & R/T Apply Chief Pilot. Yeadon Aviation, Yeadon Airport, Nr. Leeds. [4805

DEVELOPMENT Engineer for work on development of fuel systems and components. Knowledge of servo-mechanisms and hydraulics an advantage. Qualification H.N.C. or equivalent.
TEST Engineer and Technical Assistant for testing refuelling in flight components and installations. Experience in the Aircraft Industry not essential. Qualification H.N.C. or equivalent.
EXCELLENT working conditions. Pension Scheme. House purchase assistance considered. Within easy reach of Bournemouth. Special transport facilities. Apply in writing to Personnel Manager, Flight Refuelling Limited, Tarrant Rushton Airfield, Nr. Blandford, Dorset. [4809

TWO aircraft fitters required for work on all light and medium types of aircraft. Experience in this type of work preferred. Apply:—Portsmouth Aero Club Ltd., Airport, Portsmouth. [0013

REQUIRED: Staff Pilot for the operation of Attacker, Fury and Oxford aircraft. Apply: Manager, Airwork Ltd. Hurn Airport, Christchurch, Hants. [4801

SENIOR & Intermediate Design Draughtsman urgently required for interesting programme of work on new supersonic Aircraft in Glasgow. Apply in confidence to Box No. 0091. [4799

TEST and Laboratory Engineers required for gyro and electro mechanical instruments. Apply stating age, experience and salary required to S. G. Brown, Ltd., Shakespeare Street, Watford, Herts. [0147

ENGINEER, not necessarily licensed, required primarily for maintenance of flying school fleet. Previous light aircraft experience essential, and must be able to work on own initiative. Light Plane Maintenance Services, Elstree Aerodrome, Elstree, Herts. Telephone Elstree 3586. [4815

SAUNDERS-ROE LIMITED invite applications from Senior Electrical Draughtsmen of H.N.C. standard to work in their Osborne, Isle of Wight Design Department. Suitable experience in the aircraft industry would be an advantage. Assistance with housing accommodation is available.
A SUMMARY of previous experience, age, and salary, quoting ref. F/66, should be addressed to the Personnel Officer, Saunders-Roe Limited, East Cowes, Isle of Wight. [4765

SENIOR design draughtsmen, men with considerable experience in the aircraft industry, are offered the opportunity of joining an organisation engaged on work of great interest and importance.
THE successful applicants—there are only three vacancies at present, but others will probably occur later—will be men capable of preparing schemes and controlling the work of a small group. They will be offered good salaries, scope for promotion, reasonable conditions and will work in an excellent office in London. They will be expected to work hard.
THOSE interested should forward relevant details, including present salary, to Section L.5. Box No. 8942. [4762

STRESSMEN required for interesting work in new expanding department of well established firm, pleasant office situated near the South Devon coast. Apply stating age, experience and salary required to:—Design Office Superintendent, Western Airways Ltd., Exeter Airport. [4767

LICENSED engineer with A. & C. Viking required to help build up engineering company and service aircraft spending short periods abroad, with prospect of senior position in Company to right applicant. Good salary with liberal allowances when abroad.—Apply to: Independent Air Travel Ltd., Bournemouth (Hurn) Airport. Tel: Christchurch 1274. Ext. 164 [4795

DRAUGHTSMEN Junior and Intermediate, with aircraft experience, required for interesting work in new and expanding department of well established firm. Pleasant office situated near the South Devon coast. Apply, stating age, experience and salary required, to:—Design Office Superintendent, Western Airways Ltd., Exeter Airport. [4768

technicians

are required for the development of Fuel Systems for Gas Turbines, Ramjets and Rocket Motors or Powered Flying Controls for high-speed Aircraft and Guided Missiles. These posts carry good salaries and offer excellent prospects of promotion. Special interviews for which expenses will be paid, can be arranged by appointment. Those interested are asked to write giving details of education and experience to

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EMPLOYMENT OFFICER

SITUATIONS VACANT

SENIOR Designer required for entirely new project relating to road transport vehicles. This is an exceptional opportunity for a young, energetic and versatile designer to join the Project Office of an old established company. The position is open only to high class mechanical designers with a flair for invention and originality. Experience should preferably include one or more of the following:
HIGH speed I.C. Engine design, aero or car.

HIGH speed diesel engines.

AIRCRAFT gas turbines or automobile transmission system.
APPLICATIONS with full details of qualifications and past experience to Reference '634', Technical Personnel Manager, Box No. 0053. [4785

SENIOR qualified Development Engineers and Technicians required in research department of a well-known firm of precision engineers, particularly for work in connection with servo systems, small precision motors and gyroscopic control systems. Apply stating age, qualifications, experience and salary required to S. G. Brown, Ltd., Shakespeare Street, Watford, Herts. [0146

SENIOR Stressmen required by the Aircraft Division of E. G. Irwin and Partners Ltd., Burton House, High Street, Bracknell, Berks. A house in this pleasant New Town will be available to successful applicants from Greater London area. Superannuation Scheme is in operation. Write Technical Manager or phone Bracknell 376 giving brief details and salary required. [4769

AIRCRAFT Industry: Representative required by principal manufacturers in associated industry. Applicants, age 30/40 must be capable of top level negotiations and for preference with a comprehensive knowledge of blade design, development, and manufacturing processes. Total remuneration based on age and experience. Write, stating age, experience and remuneration envisaged to Secretary, Box No. 0092. [4798

APPLIED Thermodynamicists, with degree or equivalent qualification, are required for work on a wide variety of problems concerned with temperature control and refrigeration for high speed flight. There are also a number of vacancies for Technical Assistants in the above field. Please write in detail, quoting Ref. 80, to:—The Personnel Manager (Technical Employment), de Havilland Propellers Limited, Hatfield, Herts. [4810

STRESS Engineers. A number of Stress engineers are required by Vickers-Armstrongs (Aircraft) Limited at their Hursley Park design offices. The work is interesting, conditions and prospects good and salaries progressive. Previous experience is not essential but a degree or Higher National Certificate must be held. Applications should be addressed to the Personnel Manager, Vickers-Armstrongs (Aircraft), Ltd., Hursley Park, nr. Winchester. [4750

WANTED, draughtsmen to design in aluminium for sales development. Must possess Higher National Certificate in Mechanical Engineering. Location Banbury. Good working conditions and pleasant surroundings. Attractive starting salaries offered up to £800 p.a. with prospects of promotion from drawing board. Pension plan in operation. Send brief details of qualifications and experience to Northern Aluminium Co., Ltd., Bush House, Aldwych, London, W.2. [0348

MANUFACTURERS of gas turbine engines have vacancies for Mechanical Engineering Draughtsmen interested in Installation Design. Ordinary National Certificate or Higher National Certificate in Mechanical Engineering an advantage although not essential. Age limits 19 to 28. Positions hold good prospects for young men willing to learn and work hard, with commensurate salaries and pension scheme. Apply to Reference Installation/2, Box No. 8528. [0462

ARMSTRONG SIDDELEY has a vacancy for a flight test observer in connection with flight testing gas turbine engines. Applicants should have a Degree or equivalent in either Mech. or Aeronautical Engineering. Previous flying experience not necessary. Selected applicants will be required to undergo a medical examination. Good salary offered dependent on age, experience and qualifications. Applications to Reference FL/T, Armstrong Siddeley Motors, Coventry. [0463

PLANNING Engineers required by Independent Aircraft Operator at Blackbushe for a Planning Section dealing with maintenance and overhaul programmes, scheduling of aircraft, and the introduction of work study into Hangar and Workshops. Considerable experience is required of method and work study, not necessarily on aircraft maintenance work. Salary will depend on qualifications and successful applicants will be required to join Pension Scheme. Box No. 0076. [4792

WEST AFRICAN AIRWAYS CORPORATION have vacancies for Captains and First Officers. Qualifications required: Captains—Airline Transport Pilots Licence and R.T. Licence, First Officers— Commercial Pilots Licence with Instrument Rating and R.T. Licence. Experience on B.170 Freighter, Dove and Heron aircraft a desirable qualification. Commencing salaries: Captains—£1,660 p.a., First Officers—£1,270 p.a. plus in both cases Expatriation Pay of £300 p.a. Free fully furnished accommodation provided. Good leave granted and excellent pension scheme in operation. Applications to Personnel Officer (Associated Companies), P.406, B.O.A.C., Headquarters, London Airport, Feltham, Middlesex. [4794

SITUATIONS VACANT

ELECTRICAL Development Engineer required with technical and practical experience of all branches of electrics applicable to aircraft. Must be willing to accept full responsibility and be qualified to carry out an extensive programme of test work and analysis of results. A commensurate salary will be paid.
FULL particulars in writing to the Chief Engineer, The Fairey Aviation Co. Ltd., Hayes, Middlesex. [4804

FIRST class Chief Engineer and other Licensed Aircraft Maintenance Engineers required immediately for Viking airline operation in Germany. Excellent salaries. Write giving full particulars of age, licences giving numbers, details of past experience to Chief Engineer, Airwork General Trading Company, Blackbushe Airport, Camberley, Surrey. [4814

HANDLEY PAGE (READING) LIMITED, The Aerodrome, Woodley, Reading, Berks, have vacancies for Senior Stressmen for interesting work on Civil Aircraft. High commencing salaries will be paid and new houses to rent will be offered to successful applicants. Also required are Senior and Intermediate Design Draughtsmen and Weights Engineers. Superannuation and Life Assurance Scheme is in operation for all staff employees. Please send full particulars of experience etc. to the Personnel Officer. [0280

"ENGINEER required 25/30 years of age for the Development Department of medium sized Engineering Company situated in Welwyn Garden City, Herts. Applicant would be required to work with existing team in the Physical Testing Laboratory of this Company conducting material strength tests and compiling statistics. Applicant must have at least his O.N.C. with a good engineering background. This post offers good prospects with suitable advancement for suitable applicant. Staff Pension Scheme in existence." Box No. 0052. [4784

ELECTRONICS Engineer—an experienced engineer is required for design and development work on part of a Guided Weapon System. This is a post of great interest and responsibility; rapid promotion is possible for a man of initiative and knowledge. Candidates should have at least two years experience and be of degree standard, although applicants without this qualification will be considered. Please write, giving full details of age, qualifications and previous experience, quoting Ref. 73, to:—The Personnel Manager (Technical Employment), de Havilland Propellers Limited, Hatfield, Herts. [4811

SITUATIONS VACANT

BRITISH WEST INDIAN AIRWAYS have vacancies for co-pilots based in Trinidad. Applicants should be in possession of a Commercial or Senior Commercial Pilot's Licence with Instrument Rating or Airline Transport Pilot's Licence. Experience on Dakota, Viking or Viscount aircraft a desirable qualification. Commencing salary from £1,152 p.a. to £1,632 p.a. according to qualifications and experience. Excellent Provident Scheme in force allowing for payment of substantial gratuity after ten years service. Six weeks annual leave in U.K. Applications in writing to Personnel Officer (Associated Companies), B.O.A.C., P.406, Headquarters, London Airport, Feltham, Middlesex. [4707

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LYDD AIRPORT, LYDD, KENT

SITUATIONS VACANT

ARMSTRONG-SIDDELEY MOTORS have vacancies in their gas turbine development staff for work on Sapphire and Viper aero engines. Applicants must have a University Degree. Previous experience, although desirable, is not essential. Initial salaries in the range of £600-£1,000 per annum, dependent on age, experience and qualifications. Due to heavy forthcoming commitments and consequent expansion of departments, prospects for men of the right calibre are unusually good. Applications with full details to Reference EXP/SV, Technical Personnel Manager, Armstrong-Siddeley Motors, Coventry. [0460

THE Aerodynamics Department of Armstrong Siddeley Motors has vacancies for both Senior and Junior Development Engineers for work on axial flow compressors, turbines and general airflow. A Degree in Mechanical Engineering and previous experience in this type of work an advantage. Initial salaries range from £650-£1,050 per annum dependent on age, experience and qualifications but superscale rates would apply to senior experienced men. Excellent prospects and good pension fund. Applicants should give full details quoting Reference Airflow 2, to Technical Personnel Manager, Armstrong Siddeley Motors, Coventry. [0466

SITUATIONS WANTED

PILOT C.P.L. R/T & I/R. 1600 hours 1350 command, mostly twins. Tropical experienced. Aged 28, seeks position, preferably overseas, available now. Box No. 0095. [4803

PILOT, aged 33, recently returned from abroad, 2400 hours, of which 1700 in last two years, charter and instruction, light aircraft, also ARB "C" licence. Permanent progressive position sought, charter, instruction, flight test staff or other, all suggestions welcomed. Able procure U.K. Commercial or I.R. reasonably short period and if necessary ALTP later. Excellent reference from previous employer. Box No. 0157. [4816

BOOKS, ETC., WANTED

ANY Aviation books and photos wanted, especially Janes 1914-18 narratives, 1939-45 recognition booklets and magazines. Send for free list of highest cash prices paid. Aeroplane Book Supply (Dept. 7), 28 St. Andrew's Gardens, Toronto, 5, Canada. [4225

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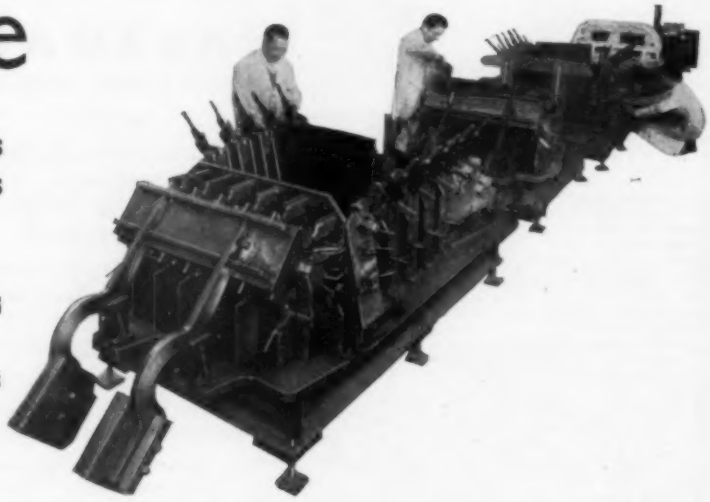

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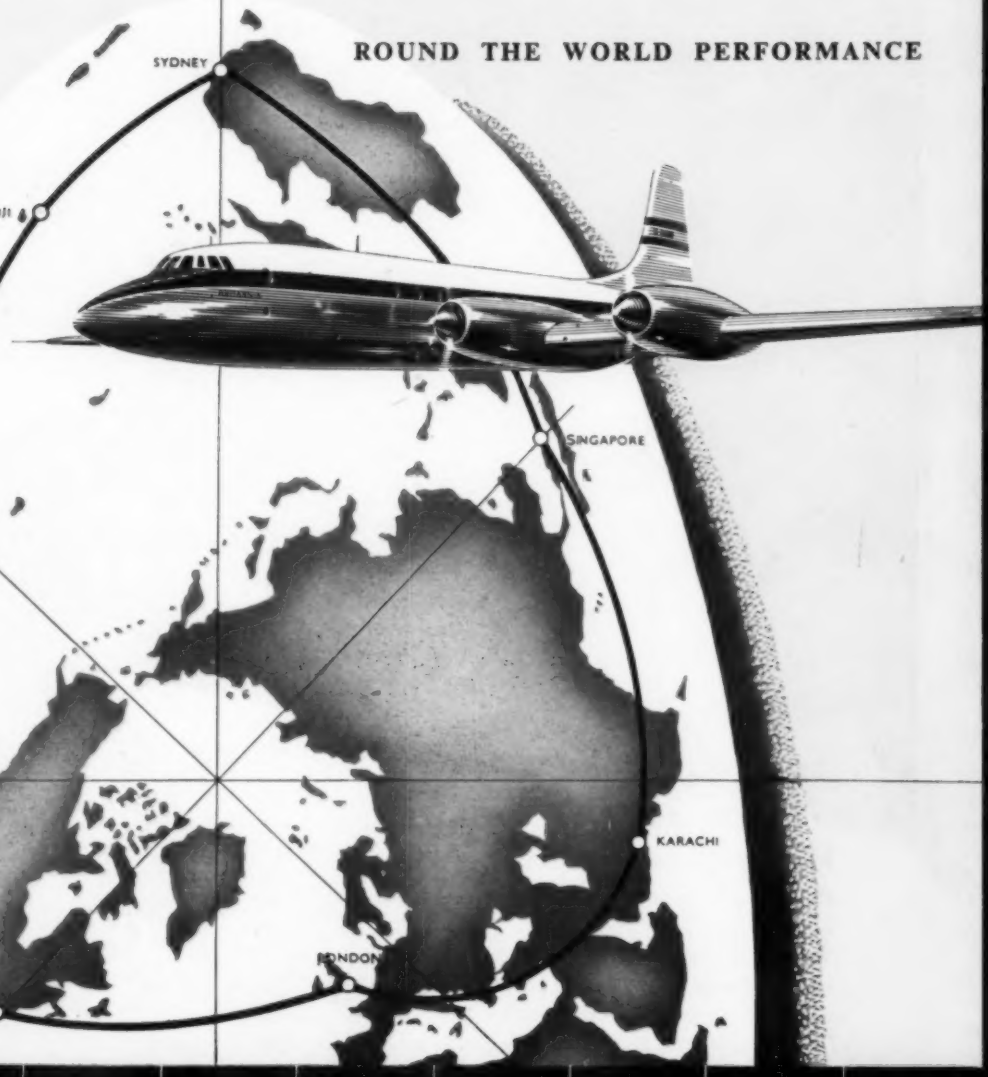

STAGE from	LONDON	KARACHI	SINGAPORE	SYDNEY	FIJI	HONOLULU	SAN FRANCISCO	NEW YORK
STAGE to	KARACHI	SINGAPORE	SYDNEY	FIJI	HONOLULU	SAN FRANCISCO	NEW YORK	LONDON
STAGE DISTANCE st ml	3940	2947	3916	1970	3180	2395	2580	3444
SCHEDULE TIME hr min	10.41	8.00	10.56	5.14	9.38	6.28	6.26	9.17
BLOCK SPEED m p h	368.5	368.8	357.9	376.7	330.2	370.1	401.4	370.8
PAYLOAD lb	28,000	28,000	27,353	28,000	28,000	28,000	28,000	28,000

These route analysis data have been computed to airline reserves and allowances

BRISTOL AIRCRAFT LIMITED · FILTON ENGLAND

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